

NUCLEAR SCIENCE ABSTRACTS

Vol. 7, No. 2, January 31, 1953

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ERRATUM

The price quoted in NSA, Vol. 7, No. 1, page Supplement 1, for the annual cumulation of New Nuclear Data (NSA, Vol. 6, No. 24B) should be approximately \$0.25 instead of \$0.55.

REPORTS REFERENCE LIST

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The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

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- AECD-3463 689
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CHAPTER 3: CRITICALITY PHYSICS OF THE LOW COST REACTOR, by [P. J. Sykes and F. H. Abernethy]. [nd] Decl. Nov. 6, 1952. 25p. (AECD-3464)
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RESEARCH IN PHYSICAL METALLURGY; PROGRESS
REPORT NUMBER 32, by J. H. Hollomon and D. Turnbull.
Oct. 5, 1952. 6p. (SO-2024; Progress Report Number 32;
RL-766)
- SO-3501 539
Rensselaer Polytechnic Inst.
LIQUID-LIQUID EXTRACTION, by Peter Kisliak, Robert R.
Reeves, Joel O. Hougen. Issued July 1, 1952. 73p. (SO-
3501)
- TID-5099 544
Knolls Atomic Power Lab.
RADIATION CHEMISTRY DISCUSSIONS WITH DR. F. S.
DAINTON [ON] OCTOBER 8, 1952, by L. M. Dorfman and
S. S. Jones. Oct. 20, 1952. 3p. (TID-5099)
- UCLA-232 475
Atomic Energy Project, Univ. of Calif., Los Angeles
RELATION OF X-IRRADIATION DOSAGE AND ELAPSED
TIME TO THE DESTRUCTION OF HEMATOPOIETIC CELLS
OF TADPOLES, by Bennet M. Allen, Ole A. Schjeide, Mary
J. Millard, and Ronald Piccirillo. Issued Oct. 27, 1952.
21p. (UCLA-232)
- UCLA-234 540
Atomic Energy Project, Univ. of Calif., Los Angeles
A PARTITION CELL FOR THE SPINCO PREPARATORY
ULTRACENTRIFUGE, by Ole Arne Schjeide and Reginald
W. Dickinson. Issued Nov. 14, 1952. 7p. (UCLA-234)
- UCRL-1929 620
Radiation Lab., Univ. of Calif., Berkeley
DESIGN OF RADIATION HEATED CATHODES FOR ION
PUMPS, by W. E. Bush. Oct. 9, 1952. 24p. (UCRL-1929)
- UCRL-1932 678
Radiation Lab., Univ. of Calif., Berkeley
OPERATION OF THE BERKELEY BEVATRON POWER
SUPPLY REGULATORS, by Robert A. Bruns. Aug. 1952.
18p. (UCRL-1932)
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Radiation Lab., Univ. of Calif., Berkeley
THE PATH OF CARBON IN PHOTOSYNTHESIS. XX. THE
STEADY STATE, by M. Calvin and Peter Massini. Sept.
1952. 49p. (UCRL-1950)
- UCRL-1957 524
Radiation Lab., Univ. of Calif., Berkeley
THE REDUCTION OF C¹⁴ LABELED CARBON DIOXIDE
AND FATTY ACIDS WITH LITHIUM ALUMINUM HYDRIDE,
by D. E. Pack and B. M. Tolbert. Sept. 1952. 11p.
(UCRL-1957)
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Radiation Lab., Univ. of Calif., Berkeley
A TEST OF THE CHARGE SYMMETRY HYPOTHESIS:
POSITIVE TO NEGATIVE PION PRODUCTION RATIO OB-
TAINED IN BOMBARDING CARBON WITH ALPHA PAR-
TICLES AND PROTONS, by H. W. Wilson and Walter H.
Barkas. Oct. 1952. 10p. (UCRL-1991)
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A RADIOCHEMICAL AND AUTOGRAPHIC STUDY OF THE
DISTRIBUTION OF POLONIUM IN RATS AFTER INTRA-
VENOUS ADMINISTRATION, by John C. Gallimore, Jr.
Atomic Energy Project, Univ. of Rochester and Oak Ridge
Inst. of Nuclear Studies. Oct. 6, 1952. 76p. (UR-220)
- Y-914 495
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SKIN DECONTAMINATION; A LITERATURE SEARCH, by
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- OTHER UNCLASSIFIED REPORTS OF SPECIAL
INTEREST TO AEC LABORATORIES
- AERE C/M 154 520
Atomic Energy Research Establishment, Harwell, Berks
(England)
THE DETERMINATION BY RADIOACTIVATION OF AR-
SENIC OCCURRING IN HIGH PURITY SULPHUR USED BY
ISOTOPES DIVISION, by L. Salmon. 1952. 3p. (AERE
C/M 154)
- AERE C/R 995 552
Atomic Energy Research Establishment, Harwell, Berks
(England)
QUATERNARY AMMONIUM NITRATES. PART I. PREPA-
RATION FROM ALKYL NITRATES AND α - ω -POLY-
METHYLENE DINITRATES, by E. S. Lane. Aug. 15, 1952.
8p. (AERE C/R 995)
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Atomic Energy Research Establishment, Harwell, Berks
(England)
THE DETERMINATION OF TRACE GASES IN METALS ON
A MICRO SCALE BY THE VACUUM FUSION METHOD, by
J. N. Gregory, D. Mapper, and J. A. Woodward. Aug. 18,
1952. 23p. (AERE C/R 1000)
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Atomic Energy Research Establishment, Harwell, Berks
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EXPERIMENTS ON THE UPTAKE OF IODINE 131 VAPOUR
BY GRASS, by A. C. Chamberlain and R. C. Chadwick. Aug.
6, 1952. 10p. (AERE HP/R 993)
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Atomic Energy Research Establishment, Harwell, Berks
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RADIO-ISOTOPES OF IRON—PREPARATION OF SOLU-
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K. J. Taylor. 1952. 3p. (AERE I/M 18)
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Atomic Energy Research Establishment, Harwell, Berks
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MEASUREMENT OF THE NEUTRON SPECTRUM AT THE
CENTRE OF THE HARWELL PILE, by B. T. Taylor. Sept.
1, 1952. 20p. (AERE N/R 1005)
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Atomic Energy Research Establishment, Harwell, Berks
(England)
LECTURE NOTES ON PILE THEORY, by C. A. Rennie.
1952. 33p. (AERE R/L 5)
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Atomic Energy Research Establishment, Harwell, Berks
(England)
A QUANTITATIVE STUDY OF URANIUM-GRAPHITE LAT-
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Aug. 11, 1945. Revised June 1952. 41p. (AERE R/R 922)
- AERE T/R 997 607
Atomic Energy Research Establishment, Harwell, Berks
(England)

A PHENOMENOLOGICAL THEORY OF THE CONSTRICTED GAS DISCHARGE AT MODERATE CURRENTS, by W. B. Thompson. May 1952. 21p. (AERE T/R 997)

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Armour Research Foundation
DETERMINATION OF PHYSICAL PROPERTIES OF NON-FERROUS STRUCTURAL SHEET MATERIALS AT EL-EVATED TEMPERATURES, by D. D. Doerr. Dec. 1951. 215p. (AF-TR-6517(pt.1))

GS-C-212 567
Geological Survey
URANIUM-BEARING COAL AND CARBONACEOUS ROCKS IN THE FALL CREEK AREA, BONNEVILLE COUNTY, IDAHO, by James D. Vine and George W. Moore. 1952. 10p., 1 illus. (GS-C-212)

NACA-TN-2834 557
Lewis Flight Propulsion Lab., NACA
FLOW SURFACES IN ROTATING AXIAL-FLOW PASSAGES, by John D. Stanitz and Gaylord O. Ellis. Nov. 1952. 31p. (NACA-TN-2834)

NACA-TN-2835 558
Lewis Flight Propulsion Lab., NACA
EFFECT OF CHANGING PASSAGE CONFIGURATION ON INTERNAL-FLOW CHARACTERISTICS OF A 48-INCH CENTRIFUGAL COMPRESSOR. II—CHANGE IN HUB SHAPE, by John Mizisin and Donald J. Michel. Nov. 1952. 35p. (NACA-TN-2835)

NBS-1050 636
National Bureau of Standards
BIBLIOGRAPHY ON GEIGER-MUELLER PHOTON COUNTERS, by Edward J. Walker. Feb. 1, 1952. 16p. (NBS-1050)

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Radiation Physics Lab., National Bureau of Standards
REPORT ON SOME CHARACTERISTICS OF THE IET DECIMAL COUNTING TUBE, by Edward R. Saunders. Oct. 10, 1952. 7p. (NBS-1990)

NEPA-249 559*
NEPA Div., Fairchild Engine and Airplane Corp.
AN APPROXIMATE METHOD FOR ESTIMATING THE TOTAL-PRESSURE LOSS FOR FLOW OF AIR THROUGH TUBES WITH HEATING AND FRICTION; AIRPLANE DESIGN SECTION MEMORANDUM TECHNICAL REPORT NO. DR-1, by M. L. Lesser. June 1947. 23p. (NEPA-249; DR-1)

NEPA-1550 553*
Chemical Research Lab., Metal Hydrides, Inc.
THIRD TOPICAL REPORT [ON] APPRAISAL OF THE WEICHSFELDER METHOD FOR PREPARATION OF IRON AND NICKEL HYDRIDES, by M. Douglas Banus and Thomas R. P. Gibb, Jr. July 31, 1950. 15p. (NEPA-1550)

NEPA-1850 579*
NEPA Div., Fairchild Engine and Airplane Corp.
BEAM THEORY FOR BENDING OF BARS UNDER CREEPING CONDITIONS, by W. Kenneth Bodger. Apr. 1951. 66p. (NEPA-1850)

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FINAL REPORT ON WORK ACCOMPLISHED ON ITEM 1, AMENDMENT NO. 3, EXHIBIT B OF N.E.P.A. CONTRACT NO. SC-2015, by W. M. Boom. Apr. 23, 1951. 35p. (NEPA-1854; W.A.C. Serial Report No. 1523)

NP-4086 637
New York Univ.
PROGRESS REPORT NO. 5 FOR MONTHS INCLUDING FEBRUARY, MARCH AND APRIL, 1952 ON FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. July, 1952. 92p. (NP-4086; Progress Report No. 5)

NP-4127 581
California Inst. of Tech.
PREYIELD PLASTIC AND ANELASTIC MICROSTRAIN IN LOW-CARBON STEEL; SIXTH TECHNICAL REPORT, by T. Vreeland, Jr., D. S. Wood, and D. S. Clark. Sept. 1952. 28p. (NP-4127)

NP-4128 594
Purdue Research Foundation
ADIABATIC HALL EFFECT IN SEMICONDUCTORS, by V. A. Johnson and F. M. Shipley. Aug. 1952. 119p. (NP-4128)

NP-4129 560
Norman Bridge Lab., Calif. Inst. of Tech.
THEORY OF HEAT AND MASS TRANSFER FROM A SLOWLY MOVING SPHERE TO THE SURROUNDING MEDIUM, by Leo Breiman. Sept. 20, 1952. 16p. (NP-4129; Report No. 27-2)

NP-4135 565
New York State Coll. of Ceramics, Alfred Univ.
EVALUATION TECHNIQUES FOR HIGH TEMPERATURES METAL-CERAMIC MATERIALS, by W. B. Crandall and M. A. Tuttle. Sept. 15, 1952. 27p. (NP-4135; U-24706)

NP-4137 542
Solid-State and Molecular Theory Group, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT NO. 6. Oct. 15, 1952. 35p. (NP-4137; Quarterly Progress Report No. 6; U-24875)

NP-4138 582
Institute of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF DISPERSIONS OF CuAl₂ ON THE ELEVATED TEMPERATURE TENSILE PROPERTIES OF Al-Cu ALLOYS; TWENTIETH TECHNICAL REPORT, by C. D. Starr, R. B. Shaw and J. E. Dorn. Sept. 15, 1952. 23p. (NP-4138; U-24757; Technical Report No. 20)

NP-4177 518
Institute of Tech., Univ. of Minnesota
DIFFUSION IN CATALYTIC HETEROGENEOUS SYSTEMS; STUDIES IN VAPOR PHASE ESTERIFICATION, by Neal R. Amundson and Michael Stusiak. Nov. 3, 1952. 191p. (NP-4177; U24809)

NP-4180 583
New York Univ.
INTERIM TECHNICAL REPORT NO. 2 [ON] THE QUENCH HARDENING OF TITANIUM-MANGANESE ALLOYS, by Y. C. Liu and H. Margolin. June 25, 1952. 20p. (NP-4180; Interim Technical Report No. 2; WAL-401/88-15)

NP-4198 584
Battelle Memorial Inst.
FINAL TECHNICAL REPORT ON SURFACE HARDENING OF TITANIUM BY CARBURIZING AND INDUCTION HEAT TREATING COVERING THE PERIOD AUGUST 1, 1951 TO AUGUST 31, 1952, by A. J. Griest, P. E. Moorhead, W. M. Parris, P. D. Frost, and J. H. Jackson. Aug. 31, 1952. 67p. (NP-4198)

NP-4203 623
ANG. EN NY METOD FOR ISOTOPSEPARERING. [NOTES ON A NEW METHOD OF ISOTOPE SEPARATION], by Nore Bergner. June 7, 1948. 71p. (NP-4203)

NP-4204	562	TEI-273	570
Applied Science Research Lab., Univ. of Cincinnati		Geological Survey	
PROGRESS REPORT NO. 1 FOR JULY 1, 1951-OCTOBER 1, 1951 ON A STUDY OF POROUS MEDIA BY MEANS OF FLOW METHODS, by John Ross and Gerard Kraus. Oct. 3, 1951. 14p. (NP-4204; Progress Report No. 1)		A NOMOGRAM FOR OBTAINING PERCENT COMPOSITION BY WEIGHT FROM MINERAL-GRAIN COUNTS, by Robert Berman. Oct. 1952. 8p. (TEI-273)	
NP-4216	585	TEI-274	571
Notre Dame Univ.		Geological Survey	
CONTRACTOR'S TECHNICAL REPORT NO. 1 [ON] ORDER-DISORDER TRANSFORMATIONS IN METALLIC ALLOYS FOR THE PERIOD OCT. 17, 1952 TO NOV. 17, 1952, by G. C. Kuczynski. Nov. 17, 1952. 4p. (NP-4216)		SPECTROGRAPHIC IDENTIFICATION OF MINERAL GRAINS, by J. N. Stüch. Oct. 1952. 41p. (TEI-274)	
NRL-4015	650	TEI-281	572
Naval Research Lab., Electricity Div.		Geological Survey	
RESONANCE ABSORPTION OF MICROWAVES BY PARAMAGNETIC SUBSTANCES, by Chihiro Kikuchi and Walter W. Wada. Sept. 22, 1952. 69p. (NRL-4015)		RECONNAISSANCE FOR URANIUM-BEARING CARBONACEOUS ROCKS IN NORTHWESTERN COLORADO, SOUTHWESTERN WYOMING, AND ADJACENT PARTS OF UTAH AND IDAHO, by James D. Vine and George W. Moore. Oct. 1952. 25p. (TEI-281)	
NRL-4062	638	USNRDL-366	476
Naval Research Lab., Metallurgy Div.		Naval Radiological Defense Lab.	
DOSIMETRY OF IONIZING RADIATIONS BY MEANS OF COLOR CENTERS IN SENSITIZED ALKALINE-EARTH SALTS, by James H. Schulman, Robert J. Ginther, and Russell D. Kirk. Oct. 13, 1952. 18p. (NRL-4062)		INDIRECT EFFECTS OF LOCALIZED DEUTERON IRRADIATION OF THE RAT, by V. P. Bond, M. N. Swift, S. T. Taketa, G. P. Welch, and C. A. Tobias. Aug. 26, 1952. 22p. (USNRDL-366)	
TEI-270(pt.1)	569	USNRDL-370	494
Geological Survey		Naval Radiological Defense Lab.	
TRACE ELEMENTS RESEARCH QUARTERLY PROGRESS REPORT [FOR] JANUARY 1 TO MARCH 31, 1952. 63p. (TEI-270(pt.1))		FURTHER STUDIES ON POST-IRRADIATION PROTECTION BY SPLEEN HOMOGENATES: AGE, STRAIN AND SPECIES FACTORS, by Leonard J. Cole and Marie E. Ellis. Sept. 15, 1952. 21p. (USNRDL-370)	

BIOLOGY AND MEDICINE

466

Quantitest Chemical Corp.

MEASUREMENT OF ALBUMINURIA: A COMPARISON OF β -NAPHTHALENE SULFONIC ACID AND SULFOSALICYLIC ACID AS PRECIPITATING REAGENTS AND THE INFLUENCE OF POLYPEPTIDES, by George V. Kropp and Ralph W. McKee. Quantitest Chemical Corp. and Cancer Research Inst., New England Deaconess Hospital, Boston. [nd] 16p. (AECU-2293)

A comparison is reported of results obtained from the use of sulfosalicylic acid according to the Kingsbury-Clark method with those obtained from the use of β -naphthalene sulfonic acid according to the Quantitest method for the quantitative determination of albumin and other proteins in urine. Results obtained from the two methods are compared with nitrogen determinations obtained on the same urine specimens after exhaustive dialysis to remove nonprotein nitrogenous materials. The data presented indicate a marked variance between the results obtained by the two methods and a difference in the influence of polypeptides on the precipitation of protein by the two methods. (C.R.)

467

Pennsylvania Univ. School of Medicine

RESTATEMENT OF THE EVIDENCE FOR MITOSIS IN BACTERIA, by Edward D. DeLamater. [nd] 26p. (AECU-2297)

Further evidence for the occurrence of mitosis in three bacteria is presented, along with a detailed study of the prophase chromosomes in one, *B. megaterium*. Applicability of the methods to other forms is demonstrated. (auth)

468

A NEW DETECTION METHOD FOR RADIOACTIVE SUBSTANCES IN TISSUE SECTIONS BY IMPREGNATION WITH SILVER SALTS. Manfred Siess and Gerhard Seybold. *Klin. Wochschr.* 30, 601-3(1952) July. (In German)

Some disadvantages of the stripping-film technique of autoradiography are avoided by direct impregnation of the tissues with the Ag-salt precipitate. Paraffined sections 5 to 7 μ thick are dried, embedded in celloidin, soaked in NaBr-NaH₂PO₄ solution, then immersed briefly in AgNO₃ solution. FeSO₄ is used as a developer. Histological staining can be performed on the same sections. Thyroid tissues thus treated of I¹³¹-injected guinea pigs are illustrated. (G.Y.)

RADIATION EFFECTS

469

New England Deaconess Hospital, Boston

BRAIN METABOLISM IN THE EMBRYO, NEWBORN AND ADULT. THE EFFECTS OF CORTISONE, ASPHYXIA, RADIATION AND OTHER INHIBITORS, by Samuel P. Hicks. New England Deaconess Hospital, Boston and Harvard Cancer Commission and Harvard Medical School. [nd] 40p. (AECU-2292)

Adult, pregnant, and newborn rats and mice were administered ionizing radiation and various other forms of

metabolic inhibitors. The acute effects were studied in tissue sections and in intact animals. The results are compared with previously obtained data of a related nature and characterization is made of the metabolism of the nervous system as it develops from embryo to adult. Possible metabolic pathways used by the nerve cell as it develops are discussed in relation to the experimental results. (C.R.)

470

Argonne National Lab.

THE EFFECT OF X IRRADIATION ON THE METABOLISM OF PHOSPHORUS-CONTAINING COMPOUNDS IN MELANO-PLUS DIFFERENTIALIS EGGS, by J. V. Passonneau. Oct. 1952. 24p. (AECU-2304; UAC-663)

The present study shows that x irradiation produces degradation and inhibits the synthesis of nucleic acids in grasshopper eggs. Degradation was a delayed effect, since the nucleic acid fractions did not decrease significantly in the x-rayed diapause eggs until 40 days after treatment. The affect appeared to be a result of metabolic dysfunction rather than direct polymerization. The irradiated cell was unable to replace the nucleic acids as they broke down. The cytoplasm and the nucleus of diapause eggs were sensitive to irradiation, since a decrease was found in the DNA and RNA phosphorus. Inhibition of nucleic acid synthesis was most marked in the postdiapause eggs. Control eggs showed a significant increase in DNA and RNA phosphorus. The x-rayed eggs exhibited no change in RNA, but a significant decrease was found in DNA phosphorus after 14 days. Inhibition of synthesis and degradation of the DNA fraction was evident in this series. The nucleus of postdiapause eggs appeared to be more susceptible to irradiation damage than the cytoplasm. (auth)

471

Los Alamos Scientific Lab.

PHYSICOCHEMICAL EFFECTS OF RADIATION. II. EFFECT OF X-RAYS ON THYMUS SODIUM DESOXYRIBONUCLEATE AS REVEALED BY THE ULTRACENTRIFUGE AND VISCOSITY, by Virgil L. Koenig and J. D. Perrings. [nd] 32p. (AECU-2319; LADC-1297)

Two samples of thymus sodium desoxyribonucleate were irradiated in the dry state with varying amounts of soft x rays. Sedimentation studies on solutions of these samples dissolved in 0.2M NaCl revealed that the higher doses of radiation produce marked reduction in sedimentation constants at zero concentration (S_{20}^0). With the lower doses of irradiation, an increase in S_{20}^0 occurs, and this increase has been explained as compensatory. One sample of thymus sodium desoxyribonucleate dissolved in 0.2M NaCl was irradiated with varying amounts of soft x rays. Sedimentation studies were made on these solutions. It was found that with the lower doses of irradiation the value of S_{20}^0 increased, but with higher doses the value of S_{20}^0 was markedly decreased. At the lower doses of irradiation, heavier components appeared, but these heavier components disappeared with the higher doses of irradiation. Much greater alteration of the molecule was accomplished by irradiation in the dissolved state than was accomplished for an equivalent dose administered in the dry state. The intrinsic viscosity of

thymus sodium desoxyribonucleate whether determined by a capillary viscometer or a rotational viscometer shows a significant decrease proportional to the amount of radiation administered to the dry sample. The values of S_{20}^0 and the values of weight intrinsic viscosity indicate a reduction in the size of the thymus desoxyribonucleate molecule upon irradiation with soft x rays. (auth)

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Brookhaven National Lab.

RADIATION STERILIZATION: II. THE EFFECT OF HIGH ENERGY GAMMA RADIATION FROM KILOCURIE RADIO-ACTIVE SOURCES ON STEROID HORMONES, by William Tarpley, Milton Yudis, Bernard Manowitz, Robert V. Horrigan, and Jerome Weiss. Brookhaven National Lab. and Schering Corp. Aug. 1952. 32p. (BNL-1258)

In investigating the possibilities of radiation sterilization of heat-labile pharmaceutical materials after packaging, a study was made of changes produced by γ radiation on the steroid hormones, cortisone acetate and pregnenolone acetate. The choice of these substances was dictated by the relative instability of cortisone acetate suspensions to heat sterilization. Irradiation with from two to four times the sterilization dose of γ radiation produced no changes in the molecules detectable by appearance, or by the physical and chemical criteria applied. Irradiated cortisone acetate and pregnenolone acetate suspensions were found to satisfy all normal specifications, with the exception of melting range, and to meet rigorous general and specific tests designed to detect minute changes. Evidence indicates there is no loss of the functional groups believed to be responsible for the biological activity. (C.R.)

473

Brookhaven National Lab.

SUPPRESSION OF GASTRIC ACIDITY BY RADIO KRYPTON, by Winton Steinfeld. [nd] 4p. (BNL-1272)

The disadvantages of inducing achlorhydria with radio-isotopes in solids or liquids led to the use of radioactive gases to inflate a balloon within the stomach. Survey experiments on dogs with A^{41} were followed by tests with Kr^{86} , preferred because it emits only β radiations. Changes in gastric pH and pathological changes in the stomach wall are described for both series. (G.Y.)

474

Vitro Corp. of America

QUARTERLY PROGRESS REPORT [ON] INDUSTRIAL APPLICATION OF GROSS FISSION PRODUCTS [FOR] JULY 1, 1952 - SEPTEMBER 30, 1952; Job 24. Oct. 24, 1952. 15p. (KLX-1381)

Commercial production packaging of typical foods and drugs having a sterilization, pasteurization, or insect control requirement has been observed. After study of each facility, a tentative location in the particular process has been selected for a radiation source. The source location was chosen to avoid alteration to the existing process arrangement. On this basis, multi-megacurie sources would be required; this high demand is caused by poor radiation geometry as well as inefficient absorption of radiation by the target material. Most industries considering the utilization of a radiation source would thus be obliged to revise some of the existing conveyor line arrangements to overcome these deficiencies. Consideration must also be given to batch radiation schemes as a means of reducing source requirements to a practical level. (auth)

475

Atomic Energy Project, Univ. of Calif., Los Angeles
RELATION OF X-IRRADIATION DOSAGE AND ELAPSED TIME TO THE DESTRUCTION OF HEMATOPOIETIC CELLS OF TADPOLES, by Bennet M. Allen, Ole A. Schjeide, Mary

J. Millard, and Ronald Piccirillo. Issued Oct. 27, 1952. 21p. (UCLA-232)

X irradiation ranging from 25 to 10,000 r produced destruction of hematopoietic cells of *Rana catesbiana*. The degree of destruction increased with the dose. In general the higher doses of radiation were associated with an earlier completion of pyknosis. The amount of hematopoietic tissue decreased after all but the lightest doses of radiation. With doses from 250 to 750 r, mitotic figures were seldom seen before the fifth post-irradiation day after which their numbers increased with time. Higher doses of radiation resulted in lower rates of division. After a dose of 1000 r all hematopoietic cells had ceased to divide by the 30th post-irradiation day. When the post-irradiation maintenance temperature of the tadpole was lowered from 20 to 4.5°C there was a marked reduction in pyknotic hematopoietic cells after both 500 and 10,000 r. In these two dose groups the number of pyknotic cells at the end of 10 days was about equal and approximately ten times that found at the end of 1 day. (auth)

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Naval Radiological Defense Lab.

INDIRECT EFFECTS OF LOCALIZED DEUTERON IRRADIATION OF THE RAT, by V. P. Bond, M. N. Swift, S. T. Taketa, G. P. Welch, and C. A. Tobias. Aug. 26, 1952. 22p. (USNRDL-366)

A cylindrical $\frac{1}{8}$ -inch-diameter beam of 190-Mev deuterons was used to obtain selective irradiation of head, liver, adrenal, intestine, and hindquarters regions in the intact unanesthetized rat. Following doses of 3564 rep to these regions, the weights of spleen, thymus, adrenals, kidneys, and testis were determined in animals sacrificed at 1, 3, 6 and 9 days post-irradiation. The changes observed in thymus, spleen, and adrenal weights in the several experimental groups were those characteristic of pituitary-adrenal stimulation, and occurred only if and when the irradiation given imposed severe stress upon the animal as indicated by the appearance of gross symptoms of illness and body weight loss. Changes in kidney and testis weights roughly paralleled body weight loss. (auth)

477

SYNERGISTIC ACTION OF CORTISONE AND TOTAL-BODY IRRADIATION IN MICE. John H. Wentworth, and John A. Billows. *Radiology* 59, 599-63(1952) Oct.

A report is presented of the results of joint administration of cortisone and whole-body irradiation in a small series of mice. A lethal synergistic effect was demonstrated. Inhibition of sulfhydryl obligate intracellular enzyme systems by inactivation of the sulfhydryl radical is suggested as a common basic mechanism. (auth)

478

APPLICATION OF SINGLE EXPOSURES OF SHORT DURATION AND GREAT INTENSITY FOR DYNAMIC INVESTIGATION OF RADIOBIOLOGICAL EFFECTS. G. A. Medvedeva, M. N. Meisel, and Ya. L. Shekhtman. *Zhur. Obshchei Biol.* 13, 243-5(1952) May-June. (In Russian)

Endomyces magnusii yeast cells were intensely x irradiated with 500,000 r or more at the rate of either 21,000 or 1400 r/min. Structural changes in nuclei, protoplasm, and chondrosomes are described, and their relation to the target theory of radiation damage is discussed. 5 figures. (G.Y.)

479

HISTOPATHOLOGICAL EFFECTS OF IMMEDIATE AND DELAYED RADIATION DEATH IN HAMSTERS PRODUCED BY TWO MILLION VOLT X-RAYS. I. THE LYMPHOCYTIC ORGANS: SPLEEN, LYMPH NODES, THYMUS AND BONE MARROW. Roberts Rugh, Barnet Levy, and Lottie Sapadin. *J. Morphol.* 91, 237-68(1952) Sept.

Immediate histopathological effects observed in the spleen

lymph nodes, thymus, and bone marrow of hamsters following exposure to 1500 r of x radiation (LD_{50} 30 days about 800 r) are compared with those observed in the same tissues when the animals were exposed continuously to a lethal dose of approximately 110,000 r. Changes observed in each tissue are summarized and are demonstrated photographically. 23 references. (C.R.)

480

ACTION OF RADIOACTIVE POTASSIUM ON THE ISOLATED INTESTINAL MUSCLE. Ch. Combescot. *Algérie méd.* 56, 393-402(1952) Aug.-Sept. (In French)

Replacement of the K in Tyrode's solution by sufficient carrier-free K^{42} to equal the radioactivity of the natural K resulted in the same effect on contraction and survival of rat and rabbit intestine as that of Tyrode's solution not containing K ion. Neither were significant differences observed between the effects of solution of equal K concentration but different radioactivities. It is concluded that the physiological properties of natural K do not depend on its radioactivity. (G.Y.)

481

PROTECTION OF THE SPLEEN IN RATS SUBMITTED TO A LETHAL DOSE OF X RAYS. M. Mandart and G. Lambert. *J. belge radiol.* 35, 337-48(1952). (In French).

Since protection of the spleen is known to increase the survival of x-irradiated rats, the authors have attempted to duplicate these results by implanting whole, fragmentary, or embryonic (homograft and autograft) spleens and by injecting various splenic extracts. In order to elucidate the mechanism of action of the spleen, irradiations of various organs, splenectomies, and ligation of the splenic pedicle also were carried out. (tr-auth)

482

EXPERIMENTAL AND STATISTICAL STUDY OF THE RADIOLESION IN VITRO. L. Martin. *J. belge radiol.* 35, 393-400(1952). (In French)

In order to study with a radiochemical model the action of x rays on aqueous solutions in vitro the author irradiated, under reproducible conditions, a solution of methylene blue. An exponential curve decreasing as a function of the dose was observed. In order to elucidate the physical significance of the exponential parameter, irradiations were made at various initial concentrations. A nonclassical radiochemical model is proposed. The ionic yield was found to be practically constant with concentration change. A statistical test permits fixing the precision of the ionic yield. (tr-auth)

483

OBSERVATIONS ON SERUM PROTHROMBIN CONVERSION ACCELERATOR IN RADIATION-INDUCED PANCYTOPENIA. George J. Jacobs, Eugene P. Cronkite, and Sidney G. White. *Am. J. Physiol.* 170, 390-5(1952) Aug.

The evolution of serum prothrombin conversion accelerator is impaired in the irradiated dog, but this impairment is not due to a deficiency of SPCA precursor. The prolonged clotting time associated with radiation induced thrombocytopenia results in a high residual prothrombin when blood is permitted to clot spontaneously with a consequent very slow evolution of SPCA. More than normal amounts of SPCA are evolved when the prothrombin conversion is accelerated by mechanical or chemical means. Transfusion of normal serum did not correct the coagulation defect of radiation sickness in two dogs. SPCA synthesis is not dependent upon an intact lymphatic apparatus, bone marrow, or the presence of platelets. (auth)

484

RESPONSE OF X-IRRADIATED MICE TO INTRAVENOUS INOCULATION OF INTESTINAL BACTERIA. M. H. Hatch,

H. B. Chase, P. F. Fenton, W. Montagna, and J. W. Wilson. *Proc. Soc. Exptl. Biol. Med.* 80, 632-5(1952) Aug.-Sept.

Intravenous inoculation of mice with *Proteus* following moderate total-body x irradiation caused a marked increase in mortality and a much shorter median death time compared with control animals injected with saline. A severe bacteremia existed before death in these animals. Nonirradiated mice given the same inoculum of *Proteus* quickly reduced the number of bacteria in the blood with eventual complete clearing. No deaths occurred among these animals. Bacteremia caused by organisms common to the intestinal tract frequently occurred in the mice which died following irradiation and saline injection. (auth)

485

EFFECT OF ALTITUDE-INDUCED POLYCYTHEMIA AND RETICULOCYTOSIS ON TOLERANCE OF RATS TO RADIATION. Willie W. Smith, Walter S. Cool, Falconer Smith, and Paul D. Altland. *Am. J. Physiol.* 170, 396-400(1952) Aug.

Rats in which polycythemia had been induced by repeated exposures to simulated high altitude showed only a relative anemia following irradiation. These rats, however, had a lower tolerance to 625 or 760 r (but not to 525 r) than did ground-level controls. In rats where the altitude exposures were discontinued at the time of irradiation the harmful effect persisted. Rats showing reticulocytosis while the degree of polycythemia was still slight also showed a lower tolerance to radiation than did ground-level controls. It is concluded that the observed decrease in tolerance to radiation is associated with bone-marrow hyperplasia at the time of irradiation. (auth)

486

THE EFFECT OF THYROIDECTOMY ON THE MORTALITY AND PERIPHERAL BLOOD CHANGES OF THE RAT SUBJECTED TO WHOLE BODY X-IRRADIATION. A. L. Kretschmar, H. J. Gomberg, D. E. Weyant, and F. H. Bethell. *Endocrinology* 51, 59-65(1952) July.

Irradiation leukopenia and anemia is more severe and prolonged in thyropivic than in euthyroid animals. The probability of surviving a whole-body dose of ionizing irradiation is decreased by hypothyroidism. Certain differences of effect on neutrophils and lymphocytes are discussed. (auth)

487

THE MEDICAL EXAMINATION OF HIROSHIMA PATIENTS WITH RADIATION CATARACTS. Paul G. Fillmore. *Science* 116, 322-3(1952) Sept. 26.

A group of patients with radiation cataracts were reexamined approximately five years after being exposed within 1094 yd to radiation from the atomic bomb at Hiroshima. Physical findings are summarized. The histories did not reveal any information which suggested late effects of the atomic bomb other than visual complaints. (C.R.)

488

THERAPEUTIC EFFECTS IN HYPERTHYROIDISM FROM REPEATED DIAGNOSTIC DOSES OF I^{131} . Sidney C. Werner, Howard B. Hamilton, and Martha R. Nemeth. *Radiology* 59, 720-28(1952) Nov.

Twenty-four patients with toxic diffuse or toxic recurrent goiter were given several tracer doses of I^{131} repeated at weekly intervals, as frequently used in investigative work. Remission of hyperthyroidism resulted in 6 of the 24 patients from repeated tracer doses totaling as little as 240 μ c without other medication, but in 5 of the 6 cases remissions were not sustained beyond two to three months. Decrease of toxicity without the achievement of complete euthyroidism was achieved in another three patients. Striking changes in individual laboratory values occurred in the 15 patients failing

to show any clinical response to the tracer doses of I^{131} . Children appeared to be unusually sensitive to internal radiation effect from I^{131} . The implications of the above observations in investigative and diagnostic use of tracer methods with I^{131} are discussed. (auth)

489

BIOLOGICAL ANALYSIS OF THE RADIATION DAMAGE TO DROSOPHILA EGGS DURING 180-KV X RADIATION AND ULTRAHARD 31-MEV RADIATION. Hedi Fritz-Niggli. *Naturwissenschaften* 39, 485-6(1952) Nov. (In German)

Dose-effect curves showing, by per cent of hatching, the dependence of radiation sensitivity on the age of *Drosophila melanogaster* eggs exposed to 180-kv or 31-Mev x rays are presented and discussed. A hit-theory explanation of the results is shown to be inadmissible. (G.Y.)

490

COURSE OF TESTICULAR INJURY FOLLOWING ACCIDENTAL EXPOSURE TO NUCLEAR RADIATIONS; REPORT OF A CASE. William R. Oakes and Clarence C. Lushbaugh. *Radiology* 59, 737-43(1952) Nov.

A human case of testicular atrophy following accidental exposure to nuclear radiations is presented along with the course of regeneration as determined by sequential sperm counts and testicular biopsies done over a 5-yr period. From this study it is evident that regeneration of the atrophic human testis following irradiation is extremely slow, although similar in cytologic detail to the rapid regeneration that takes place in irradiated testes of experimental animals. The factors which might conceivably play a role in determining this slow rate of regeneration are discussed briefly. On the basis of this case, the usual dismal prognosis for regeneration of the accidentally acutely irradiated human testis should be modified toward a more hopeful prospect. (auth)

491

X-IRRADIATION AND BACTEREMIA; STUDIES ON ROENTGEN DEATH IN MICE. IV. J. W. Osborne, H. S. Bryan, H. Quastler, and H. E. Rhoades. *Am. J. Physiol.* 170, 414-17(1952) Aug.

A study was made of bacteremia in whole-body and in partial-body irradiated mice in which no evidence of intestinal damage was found. It was concluded that irradiation of the head and thorax is sufficient to elicit death due to bacteremia and that in these cases the bacteria enter through the oropharynx. (C.R.)

492

THE EFFECTS OF VARIOUS DOSES OF RADIOACTIVE IODINE ON THE FUNCTION AND STRUCTURE OF THE THYROID OF THE RAT. Farahe Maloof, Brown M. Dobyns, and Austin L. Vickery. *Endocrinology* 50, 612-38(1952) June.

Anatomical and functional changes in the thyroid gland of growing rats were studied simultaneously following the administration of graded doses of I^{131} . Changes observed at various times up to one and one-half years are described. (C.R.)

493

CHOLINESTERASE ACTIVITY, WEIGHT, WATER CONTENT AND PATHOLOGY OF SMALL INTESTINE OF RATS SUBJECTED TO X-RADIATION. Robert A. Conard. *Am. J. Physiol.* 170, 418-25(1952) Aug.

The cholinesterase activity (measured by the colorimetric method of Hestrin) of the small intestine showed significant depression at 15 to 20 hours after 500 r x irradiation, and reached a maximum of nearly 60 per cent depression by the 4th day, recovered slowly, approaching normal values by the 20th to 24th day. Changes in total body weight, and in the weight and water content of the small intestine showed

little parallelism, either in degree or in time sequence with cholinesterase activity. The gross appearance of the small intestine paralleled the cholinesterase activity more closely than did the histological appearance. Correlation of enzyme changes with intestinal motility was not apparent. (auth)

RADIATION HAZARDS AND PROTECTION

494

Naval Radiological Defense Lab.
FURTHER STUDIES ON POST-IRRADIATION PROTECTION BY SPLEEN HOMOGENATES: AGE, STRAIN AND SPECIES FACTORS, by Leonard J. Cole and Marie E. Ellis. Sept. 15, 1952. 21p. (USNRDL-370)

Biological factors such as age, strain, and species modify the phenomenon of post-irradiation protection by spleen homogenates. On the basis of protective activity per unit weight of spleen, homogenates of spleen from 1-week-old mice exhibit greater activity than do those from adult mice. A converse age effect is observed in the recipient irradiated mice, i.e., a spleen homogenate preparation which prevents death in 80 per cent of adult mice exposed to 750 r fails to protect 5-week-old mice under identical conditions. The presence of the spleen in the irradiated mouse is not necessarily required for protective action of spleen homogenates. Homogenates of spleens from LA_1 mice afford little or no protection when injected into irradiated LA_1 mice, whereas homogenates of spleens from the progeny of LA_1 , LA_2 , and LA_3 mice are effective in decreasing the mortality of irradiated LA_1 mice. A small but consistent degree of protection is observed in rats receiving rat spleen homogenate injections after exposure to 675 or 700 r. (auth)

495

Carbide and Carbon Chemicals Co. (Y-12)
SKIN DECONTAMINATION; A LITERATURE SEARCH, by Frances Sachs. Oct. 22, 1952. 26p. (Y-914)

A literature search was made of unclassified sources for references on decontamination of the skin. Included are references on skin decontamination, radiation protection, treatment of radiation injuries to skin, and related material. (C.R.)

496

RADIATION HAZARDS IN HIGH ALTITUDE AVIATION. Cornelius A. Tobias. *J. Activation Med.* 23, 345-72(1952) Aug.

Potential health hazards of cosmic radiation which may affect personnel engaged in high-altitude aviation are discussed. The distribution of different types of radiations in the cosmic radiation, dosimetry, and the expected biological effects are reviewed. 70 references. (C.R.)

497

HEMATOLOGICAL INVESTIGATIONS ON THE ACTION OF CYSTEINE. W. Lorenz. *Strahlentherapie* 88, 190-7(1952). (In German)

By intracardial injection of cysteine prior to an 800-r total-body x irradiation, the survival rate of rats was increased from 10 to 75%; those of the cysteine-injected animals that survived the irradiation showed the same damaged blood conditions as the merely irradiated controls. After adrenalectomy, radiosensitivity increased and the protective effect of cysteine decreased. (auth)

RADIOTHERAPY

498

RADIOACTIVE PHOSPHORUS IN THE TREATMENT OF VAQUEZ'S ERYTHREMIA. Georges Marchal. *Thérapie* 7, 303-5(1952). (In French)

A case history reporting the treatment of polycythemia vera with P^{32} is presented. The effectiveness of P^{32} injection

is about equivalent to that of whole-body teleroentgentherapy, but the P^{32} has many advantages. Its use does not result in radiation sickness, there is less danger of medullary inhibition, and it is easily administered. (G.Y.)

499

TWENTY CASES OF BASEDOW'S DISEASE TREATED WITH RADIOACTIVE IODINE. L. Brull, L. Lefebvre, and J. Govaerts. *J. belge radiol.* 35, 546-53(1952). (In French).

Case histories of 20 patients treated with I^{131} for exophthalmic goiter are summarized. Complete cure was obtained in $\frac{2}{3}$ of the cases and amelioration in $\frac{1}{3}$. Only in one case did the I^{131} fail completely. The urinary elimination rate of the I^{131} was determined in most of the patients. (G.Y.)

500

EXPERIMENTS ENVISAGED FOR DEMONSTRATING THE POSSIBLE FORMATION OF ANTICANCEROUS SUBSTANCES BY IRRADIATION OF CANCERS. Adolf Müller. *J. belge radiol.* 35, 360-4(1952). (In French)

Regressions of nonirradiated metastases and distant tumors following irradiation of cancers have been observed by various authors. Various possibilities of proving the presence of anticancerous substances in the blood or lymph of organisms following tumor irradiation are discussed briefly. (G.Y.)

501

ORAL THORIUM X AS REMEDY OF CHOICE IN MORBUS BECHTEREW; WITH A SUGGESTION FOR THE TREATMENT OF MORBUS PAGET. Karl-Ludwig Mahlo. *Deut. med. J.* 3, 472-4(1952) Oct. 15. (In German)

Treatment of Bechterew's disease, rheumatoid arthritis of the spine, by oral ThX (Ra^{224}), a 3.64-day α emitter, gives good results and is applicable by any physician. Contraindications are leukopenia and bone-marrow damage. Valuable results also should be obtained in treatment of Paget's disease, osteitis deformans. (G.Y.)

502

FIXATION OF P^{32} BY CANCEROUS CELLS. S. Neukomm, G. Rossier, and P. Lerci. *J. belge radiol.* 35, 365-9(1952). (In French)

The authors have studied, in a case of carcinoma of digestive origin with multiple metastases, the total P^{32} content of the principal healthy organs and cancerous metastases and the P^{32} distribution between the various P fractions of these tissues. The cancerous tissues take up more P^{32} than do the healthy tissues. This augmentation is caused by an increase in the phospholipid fraction in all the metastases studied. The P^{32} concentration in the various P fractions in the metastases varies according to their location and degree of development of the cancerous tissue. (tr-auth)

503

RADIOACTIVE DI-IODOFLUORESCIN IN THE DIAGNOSIS OF INTRA-OCULAR TUMOURS. P. D. Trevor-Roper, K. A. Newton, and J. P. Nickolson. *Brit. J. Ophthalmol.* 36, 543-6(1952).

An investigation was made of the efficiency of injected radioactive diiodofluorescein in the diagnosis of ocular tumors. It was concluded that, since the selective uptake of the radioactive dye is very small as compared with that in the rest of the body, the technique cannot be recommended as a routine diagnostic procedure. (C.R.)

TOXICOLOGY STUDIES

504

ABSORPTION AND EXCRETION OF INHALED FLUORIDES; FURTHER OBSERVATIONS. G. H. Collings, Jr., R. B. L. Fleming, Roy May, and W. O. Bianconi. *Arch. Ind. Hyg. Occupational Med.* 6, 368-73(1952) Oct.

An industrial employee who had been exposed to fluorides in the air during 8 yr of work and a control subject without significant prior exposure were exposed simultaneously for 6 hr to atmospheric concentrations of fluorides averaging 4.8 mg of fluoride per cubic meter of air. Urinary excretion of fluorides by the two subjects rose during the exposure and fell rapidly to near preexposure levels within 24 hr. The base level of fluoride excretion (during times when no exposure had occurred for several days) was slightly higher for the industrial employee than for the control subject, which is considered to be a measure of the excretion from previously stored fluorides in the industrial employee. However, the transient rise of urinary fluoride excretion above the base level, produced by 6 hr of exposure to air containing fluorides, was very nearly the same for the two subjects, both in time and in amount. The total quantity of fluorides excreted above the subjects' respective base levels during the first 24 hr following 6 hr of exposure to air containing 4.8 mg of fluoride per cubic meter was 4 mg for the industrial employee and 5 mg for the control subject. These values agree well with data resulting from other similar studies on which we have previously reported. A second industrial employee with an even greater past exposure to fluorides than the first showed a similar excretion pattern following exposure for 8 hr to air-borne fluorides. Still other industrial employees, studied less extensively, showed urinary fluoride concentrations before and after exposure which were consistent with the findings of the experimental work. (auth)

TRACER APPLICATIONS

505

Lankenau Hospital Research Inst., Philadelphia
STUDIES OF GLYCINE OXIDATION IN RAT TISSUE, by Henry I. Nakada and Sidney Weinhouse. Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia and Temple Univ. [nd] 24p. (AECU-2286)

Using labeled substrates in vitro the oxidation of glycine α and β carbons was observed in rat liver and kidney but not in other organs. Glyoxylate α carbon and formate were identified as intermediates of the oxidation of the glycine α carbon, and the glyoxylate carboxyl was found to be derived from the glycine carboxyl. The interconversion of glyoxylate and glycolate occurs readily in liver and is catalyzed by DPN-specific lactic dehydrogenase. Glyoxylate was found to be oxidized by xanthine dehydrogenase to oxalate, and to formate and CO_2 by an as yet uncharacterized enzyme in rat liver. Formate is oxidized readily by a variety of rat tissues and evidence has been presented to indicate this occurs via a peroxidative activity of catalase. The data establish the following pathway of glycine oxidation in rat liver: glycine \rightarrow glyoxylate \rightarrow CO_2 + formate \rightarrow CO_2 . (auth)

506

Wyoming Univ.
METABOLISM OF RADIOPHOSPHORUS IN THE LIVER OF NORMAL ANIMALS AND IN CHRONIC SELENOSIS, by Irene Rosenfeld and O. A. Beath. [nd] 23p. (AECU-2315)

Data are presented from a study of the distribution of P in total tissue, total acid-soluble and total bound phosphates, phospholipid, inorganic, barium insoluble, barium-soluble alcohol-insoluble, and alcohol and barium soluble fractions of the liver of normal rats and in rats with chronic selenosis following intraperitoneal injection of P^{32} . (C.R.)

507

Wyoming Univ.
DISTRIBUTION OF P^{31} AND P^{32} IN THE TISSUES OF NORMAL ANIMALS AND CHRONIC SELENOSIS, by Irene Rosenfeld and O. A. Beath. [nd] 12p. (AECU-2316)

Data are presented from a study of the distribution of P in total tissue, total acid-soluble, organic and inorganic phosphate of the acid-soluble fraction in kidney, heart, spleen, and brain of normal rats and in rats with chronic selenosis following intraperitoneal injection of P^{32} . Data indicate that the rate of uptake of P is not directly related to the total phosphate content of the tissues but is governed by cellular permeability and tissue barriers within the organ. (C.R.)

508

Wyoming Univ.

DISTRIBUTION OF P^{32} IN THE TISSUES OF NORMAL ANIMALS, by Irene Rosenfeld and O. A. Beath. [nd] 9p. (AECU-2317)

The distribution and the specific activity of P^{32} in the various organs of normal rats was studied at 1, 2 and 12 hours after intraperitoneal administration of the isotope. The P^{32} was rapidly taken up by the serum and distributed in the various organs. It appears that the distribution of P^{32} was not directly related to the amount of phosphorus present in the tissue but depended on the permeability of the cells to the phosphate ion. (auth)

509

Brookhaven National Lab.

MECHANISM OF HYDROLYSIS OF ADENOSINE TRIPHOSPHATE CATALYZED BY LOBSTER MUSCLE, by Edith Clarke and D. E. Koshland, Jr. [nd] 4p. (BNL-1273)

Adenosine triphosphate (ATP) can undergo nucleophilic attack at any of its three P atoms. If it is hydrolyzed in water to adenosine diphosphate (ADP) and inorganic phosphate, the reaction mechanism pathway is not obvious since attack at either the terminal P or the middle P atom would give the same products. This ambiguity was avoided by hydrolysis of ATP in H_2O^{18} -equilibrated lobster muscle. Control experiments with P^{32} -labeled inorganic phosphates also were performed. The results prove that a nucleophilic displacement on the terminal P atom is involved. The muscle preparation also catalyzes a net transfer of O between inorganic phosphate and water. (G.Y.)

510

Radiation Lab., Univ. of Calif., Berkeley

THE PATH OF CARBON IN PHOTOSYNTHESIS. XX. THE STEADY STATE, by M. Calvin and Peter Massini. Sept. 1952. 49p. (UCRL-1950)

The separation of the phenomenon of photosynthesis in green plants into a photochemical reaction and into the light-independent reduction of carbon dioxide is discussed. The reduction of CO_2 and the fate of the assimilated C were investigated with the help of the tracer technique (exposure of the plants to the radioactive $C^{14}O_2$) and of paper chromatography. A reaction cycle is proposed in which phosphoglyceric acid is the first isolable assimilations product. Analyses of the algal extracts which had assimilated radioactive CO_2 in a stationary condition ("steady-state" photosynthesis) for a long time provided further information concerning the proposed cycle and permitted the approximate estimation, for a number of compounds, of what fraction of each compound was taking part in the cycle. The earlier supposition that light influences the respiration cycle was confirmed. The possibility of the assistance of α -lipoic acid, or of a related substance, in this influence and in the photosynthesis cycle, is discussed. (auth)

511

Atomic Energy Project, Univ. of Rochester

A RADIOCHEMICAL AND AUTOGRAFIC STUDY OF THE DISTRIBUTION OF POLONIUM IN RATS AFTER INTRAVENOUS ADMINISTRATION, by John C. Gallimore, Jr. Atomic Energy Project, Univ. of Rochester and Oak Ridge Inst. of Nuclear Studies. Oct. 6, 1952. 76p. (UR-220)

The distribution of Po chloride in the liver, spleen, kidney, muscle, and blood of rats after intravenous administration has been studied autoradiographically and radiochemically. It was found that the Po in the blood, immediately after injection, existed in two systems; a system of Po aggregates, characterized by sunbursts in the autoradiograms and the other a system of nongrouped singly dispersed atoms or molecules. The aggregates were removed from the blood stream over an approximate two hour period and deposited in the liver and spleen. The nonparticulate Po was observed to concentrate in the proximal convoluted tubules of the kidney. No particulate Po was observed to be deposited in this organ. The tissues in this study most responsible for the disappearance of the Po from the blood, arranged in order of decreasing content per gram of tissue were spleen, kidney, liver, and muscle. (auth)

512

MEASUREMENTS OF RADIOISOTOPES IN BLOOD APPLIED TO DETERMINATIONS OF THE TRUE HEMATOCRIT. W. D. Armstrong, Leon Singer, and Bryant R. Dunshee. *Proc. Soc. Exptl. Biol. Med.* 80, 639-42(1952) Aug.-Sept.

Simplified methods for sample preparation for use in estimation of I^{131} , Ca^{45} , and Na^{22} in blood and plasma are described. These methods will permit the administration of minimum amounts of I^{131} -labeled plasma proteins in studies of blood and plasma volumes. The degree of plasma trapping in the centrifuged hematocrit was determined from measurements of I^{131} -labeled albumin and Ca^{45} concentrations in equal volumes of whole blood and plasma. With normal human and dog blood 7 to 9% of the packed cell column in the hematocrit tube is plasma. The amount of plasma trapped decreases with decreasing cell-column height. The practical implications of the last observation are mentioned. (auth)

WASTE DISPOSAL

513

Atomic Energy Research Establishment, Harwell, Berks (England)

EXPERIMENTS ON THE UPTAKE OF IODINE 131 VAPOUR BY GRASS, by A. C. Chamberlain and R. C. Chadwick. Aug. 6, 1952. 10p. (AERE HP/R 993)

Field trials have been done to determine the rate of uptake of I^{131} vapor by grass. The velocity of deposition, v_g defined as rate of deposition of I^{131} per unit area of ground/amount of I^{131} vapor per unit volume of air, is found to average 2.5 cm/sec. Experiments in the open air and in a wind tunnel have been done to compare the uptake by vegetation with the uptake by filter paper. Taking the maximum permissible level of I^{131} in vegetation as 1×10^{-4} μ c/gm it is deduced that the permissible output of I^{131} from a stack is 10 mc a day for a stack height of 10 m, rising to 500 mc a day for a stack height of 100 m. (auth)

CHEMISTRY

514

Sloan-Kettering Inst. for Cancer Research

THE IDENTIFICATION OF CYTIDYLIC ACIDS a AND b, by Liebe F. Cavalieri. [nd] 5p. (AECU-2299)

High-precision measurements of the density of aqueous solutions of the isomeric cytidylic acids a and b and measurements of the dissociation constants of the 6-ammonium group showed that the b isomer has the greater separation of charge. From structural considerations, it is concluded that the b isomer is cytidine-3'-phosphate. (G.Y.)

515

Argonne National Lab.

AQUEOUS CORROSION OF 2S ALUMINUM AT ELEVATED TEMPERATURES, by J. E. Draley and W. E. Ruth. Oct. 1952. 9p. (AECU-2301; UAC-659)

The corrosion characteristics of 2S Al in water at elevated temperatures was studied. It was found that the Al corrodes uniformly in nearly pure water at rates which increase with the temperature. Normal corrosion is not rapid up to well over 250°C, but the usefulness of the material might be limited by intergranular attack which may become important at a temperature above 200°C. (J.E.D.)

j16

Rensselaer Polytechnic Inst.

DISTRIBUTION AND CONDUCTANCE STUDIES OF ISOPROPYL ETHER-HYDROGEN CHLORIDE-WATER-IRON SYSTEMS, by Donald E. Campbell. Sept. 4, 1952. 117p. (AECU-2313)

In an investigation of the factors affecting the ether extraction of inorganic ions, the isopropyl ether-iron extraction system was studied by three different approaches. The first involves a complete phase study of the ternary system isopropyl ether-HCl-H₂O. The purpose of this study is to determine the extent to which these components distribute between the aqueous and ethereal phases and then to consider the possible effects which these distributions might have on the iron distribution in the quaternary extraction system. The second approach used in this investigation is a conductometric study of the ethereal phase of the iron extraction system. This study is intended to characterize the ionic nature of the iron complex in the ether extraction phase and to check the validity of Savolainen's theory of an ionic mechanism in which the existence of a hydrated proton and a tetrachloroferrate anion is postulated. The third approach is a conductometric study of isopropyl ether solutions of iron prepared from anhydrous HFeCl₄, isopropyl ether, and water. This study is carried out to prove that the iron complex in these "synthetic extraction phases" is the same as that occurring in the normal iron extraction system. (auth)

517

Atomic Energy Research Establishment, Harwell, Berks (England)

RADIO-ISOTOPES OF IRON—PREPARATION OF SOLUTIONS OF HIGH SPECIFIC ACTIVITY, by F. Hudswell and K. J. Taylor. 1952. 3p. (AERE I/M 18)

The present methods of preparation of K ferrocyanide using the separated isotopes Fe⁵⁴ and Fe⁵⁸ are described. A very simple method is used for the separation of Fe⁵⁵, Fe⁵⁸, or a mixture of the two from the pile-irradiated ferrocyanide, and the yield is good. Recovery of the ferrocyanide for reirradiation is very important in the case of the separated isotopes, and details of the procedure are given. (auth)

518

Institute of Tech., Univ. of Minn.

DIFFUSION IN CATALYTIC HETEROGENEOUS SYSTEMS; STUDIES IN VAPOR PHASE ESTERIFICATION, by Neal R. Amundson and Michael Stusiak. Nov. 3, 1952. 191p. (NP-4177; U24809)

The continuous vapor-phase reaction of ethyl alcohol and acetic acid to form ethyl acetate and water was carried out in a fixed-bed reactor. The reactor was of stainless steel 4 ft long and 2 in. in diameter, heated by circulating Dowtherm A enclosed in a jacket. The bed contained 2170 g of dry catalyst (WO₃ carried on porous Al₂O₃ spheres averaging 0.523 cm in diameter). The dried balls were impregnated with a solution of tungstic acid in concentrated NH₄OH. The balls were dried and heated at 450°C in order

to decompose the tungstate. A catalyst particle had an apparent density of 1.6886 g/cm³, an absolute density of 3.860 g/cm³, and a fractional void volume of 0.5625. The balls contained 7.87% WO₃ by weight. The liquid reactants were pumped through flowmeters and thence into the electrical preheaters. The vaporized reactants entered the reactor at the top, passed through the catalyst bed, and then to the condenser. The product from the condenser was immediately analyzed. The apparatus was automatically temperature-controlled and operated slightly above atmospheric pressure. Kinetic data were obtained at 140, 160, and 180°C; a surface reaction was the rate-controlling step. A rate equation that reproduced the data at 160°C was

$$r = 0.0123(p_A p_B - p_R p_S/k)/(1 + 3.327p_A + 1.075p_B)^2$$

where p_A, p_B, p_R, and p_S are the partial pressures of acid, alcohol, ester, and water, respectively. The data indicated that the reaction approximated a pseudofirst-order relation when only the feed rate was varied. Intraparticle diffusion was not an important factor in determining the rate of the over-all reaction. (TID-LC)

519

[Rutgers Univ.]

THE INVESTIGATION OF THE ANIONIC COMPLEXES AND POLYMERS OF THE TRANSITIONAL ELEMENTS, by E. R. Allen. Sept. 2, 1952. 4p. (NYO-3544)

A brief survey is made of the literature relating to the triple heteropoly acids, which have been used industrially to precipitate basic dyes to form pigments. (L.T.W.)

ANALYTICAL PROCEDURES

520

Atomic Energy Research Establishment, Harwell, Berks (England)

THE DETERMINATION BY RADIOACTIVATION OF ARSENIC OCCURRING IN HIGH PURITY SULPHUR USED BY ISOTOPES DIVISION, by L. Salmon. 1952. 3p. (AERE C/M 154)

The activation method for As in a sulfur sample consists essentially of irradiating the sample, together with an As standard, in a reactor. The As undergoes a (n,γ) reaction to form As⁷⁶. After removal from the reactor the sample is dissolved and As carrier added. Active Ge and Se are removed by oxidative distillation with HCl and H₂O₂, and As is separated as the trichloride by three reducing distillations with HBr. It is precipitated from the distillate with ammonium hypophosphite, washed with water by centrifugation, and mounted for counting. The only difficulty in the procedure is the dissolution which must now allow the As to volatilize. This was overcome by dissolving the irradiated S in a warm solution of Br in CCl₄, together with As carrier and HNO₃ to ensure the higher oxidation state of As. After evaporation to dryness the residue was taken up in dilute NaOH and transferred to a distillation apparatus where the normal procedure was continued.

521

Atomic Energy Research Establishment, Harwell, Berks (England)

THE DETERMINATION OF TRACE GASES IN METALS ON A MICRO SCALE BY THE VACUUM FUSION METHOD, by J. N. Gregory, D. Mapper, and J. A. Woodward. Aug. 18, 1952. 23p. (AERE C/R 1000)

This paper describes the development of a vacuum-fusion method for determination of gases in metals on a micro scale. The experimental work involved in the development and details of the final apparatus design and method are fully described. By the use of specially prepared standards and analysis of metals of known gas content, it has been shown

that steel and U can be rapidly analysed for O, N, and H with an accuracy which is better than ± 10 ppm on a sample of 50 to 200 mg. An attempt to determine O and N in Zr on a micro scale was unsuccessful, probably because of the temperature limitations of the existing furnace. (auth)

522

Brookhaven National Lab.

REVERSIBLE REACTION OF CHLOROPHYLL GIVING THE RED-BROWN INTERMEDIATE OF THE MOLISCH PHASE TEST, by Simon Freed and Kenneth M. Sancier. [nd] 8p. (BNL-1281)

Factors affecting color changes observed spectrographically in solutions of purified chlorophyll and mechanisms activating the observed changes are discussed. (C.R.)

523

Pennsylvania State Coll.

POLAROGRAPHIC BEHAVIOR OF ORGANIC COMPOUNDS. XVI. MALEIC AND FUMARIC ACIDS: ORIGIN OF THEIR SPLIT WAVES. ANALYTICAL SIGNIFICANCE, by Philip J. Elving and Isadore Rosenthal. May 1, 1952. (NYO-854)

Maleic and fumaric acids have been systematically investigated over the pH range 0.7 to 12 at different levels of ionic strength. At about pH 5.5, the original wave of each acid begins to decrease; simultaneously, a second more negative wave appears whose height increases with pH until it alone remains. The total current for both waves is essentially equal to that for the single wave in the low pH region. Above pH 8, the second maleic acid wave begins to disappear and is practically nonexistent at pH 10. The second fumaric acid wave remains essentially unchanged over a similar pH range. The relation of these wave-splitting phenomena to the kinetics of the acid-anion equilibrium is discussed. The nature of the current-controlling processes are examined in relation to the observed temperature and height coefficients of the wave currents, and the variation of these coefficients over the pH range is investigated. The influence of background solution composition on the apparent nature of the current-controlling process is considered. The application of Herasymenko's equations to the data is examined, and the indecisiveness of the agreement is discussed. (auth)

524

Radiation Lab., Univ. of Calif., Berkeley

THE REDUCTION OF C^{14} LABELED CARBON DIOXIDE AND FATTY ACIDS WITH LITHIUM ALUMINUM HYDRIDE, by D. E. Pack and B. M. Tolbert. Sept. 1952. 11p. (UCRL-1957)

Procedures for converting carbon dioxide and the lower fatty acids labeled with C^{14} to their corresponding alcohols and halides are described. Pure products are obtained in good yield and the methods were found to be consistently reliable. (auth)

525

DETERMINATION OF ZIRCONIUM IN STEELS USING p-BROMO- OR p-CHLOROMANDELIC ACID. Joseph J. Klingenberg and Roland A. Papucci. *Anal. Chem.* 24, 1861-2 (1952) Nov.

The mandelate method was found to be superior to the cupferron method for Zr determination in steel. The p-bromo- and p-chloromandelic acids are more convenient to use than mandelic acid. The steel sample is dissolved in HCl, cooled, and filtered to remove silica and any carbides which failed to dissolve. A solution of one of the reagents is added, and the mixture is digested, cooled to room temperature, and filtered. The precipitate of Zr halomandelate is washed, charred slowly and ignited, and the resulting Zr oxide is then weighed. A complete analytical procedure for chrome steels is presented. (L.T.W.)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

526

PRINCIPAL CONSIDERATIONS IN THE PERIODIC SYSTEM OF THE ELEMENTS. V, VI, and VII. Richard Lepsius and S. K. Asunmaa. *Naturwissenschaften* 39, 477-8, 490-1 (1952). (In German)

Periodicities in the atomic and nuclear structures are correlated, and a periodic chart is presented on which spaces are available for the isotopes of each element, both electron and nucleon groupings being shown without confusion. (G.Y.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

527

Los Alamos Scientific Lab.

PREPARING THIN SODIUM IODIDE CRYSTALS WITH A MICROTOME, by Lawrence Cranberg. [nd] 3p. (AECU-2290; LADC-1278)

A technique is described for preparing extremely thin sodium iodide crystals for use as scintillators in radiation detection instruments. A standard biological microtome was used to shave down the crystal. Pulse height volts counted with a 0.005 ± 0.002 -in. microtomed crystal are compared with those obtained with a 0.060-in. cleaved crystal. No adverse effect greater than 10% was noted on the resolving power of the shaved-down crystal and use of the crystal resulted in a large reduction in background. (C.R.)

528

Rutgers Univ.

THE INVESTIGATION OF THE ANIONIC COMPLEXES AND POLYMERS OF THE TRANSITIONAL ELEMENTS, by E. R. Allen and J. L. Silver. Nov. 7, 1952. 7p. (NYO-3545)

Preliminary studies concerning the heteropoly acids are reported. X-ray-diffraction data on crystals of phosphotungstic, phosphomolybdic, and phosphotungstomolybdic acids are given. (L.T.W.)

FLUORINE AND FLUORINE COMPOUNDS

529

Carbide and Carbon Chemicals Co. (K-25)

A REVIEW OF THE FLUORIDES OF RUTHENIUM, by R. L. Farrar, Jr., E. J. Barber, R. H. Capps, M. R. Skidmore, and H. A. Bernhardt. Issued Sept. 14, 1950. Decl. with deletions Dec. 2, 1952. 17p. (AECD-3468; K-655)

A literature survey of the ruthenium fluorides has been made and older observations have been interpreted in the light of more recent knowledge. The chemical and physical properties of ruthenium pentafluoride are summarized and the contribution from this laboratory included. The preparations of ruthenium trifluoride and octafluoride are discussed. (auth)

530

Carbide and Carbon Chemicals Co. (K-25)

FREEZING POINT DIAGRAM AND LIQUID-LIQUID SOLUBILITIES OF THE SYSTEM URANIUM HEXAFLUORIDE-HYDROGEN FLUORIDE, by G. P. Rutledge, R. L. Jarry, and W. Davis, Jr. Issued Dec. 28, 1951. Decl. with deletions Dec. 2, 1952. 25p. (AECD-3469; K-845)

The complete freezing point diagram for the system UF_6 -HF has been determined. In addition, liquid-liquid solubilities of these compounds have been measured up to the consolute temperature of $101^\circ C$. A miscibility gap starts at $61.2^\circ C$ over the composition range 10 to 80 mole% UF_6 . The lowest melting point of this binary system under its own pressure, i.e., the eutectic, is $-85^\circ C$. (auth)

531

Carbide and Carbon Chemicals Co. (K-25)

THE VAPOR PRESSURE AND HEAT OF VAPORIZATION

OF URANIUM HEXAFLUORIDE, by J. W. Grisard and G. D. Oliver. Issued Feb. 28, 1951. Decl. with deletions Dec. 2, 1952. 13p. (AECD-3470; K-722)

The vapor pressure of uranium hexafluoride has been remeasured over the range 0 to 90°C and the measurements are represented by the following equations, which intersect within 0.002° of the melting point, 64.012°C. Uncertainties of the equations are approximately $\pm 0.05\%$ for pressures between 100 and 2400 mm.

$$\text{Solid, } \log_{10} P_{\text{mm}} = 6.38363 + 0.0075377t - 942.76/(t + 183.416).$$

$$\text{Liquid, } \log_{10} P_{\text{mm}} = 6.93718 - 1091.537/(t + 217.22).$$

The heats of sublimation and vaporization have been estimated by means of the Clapeyron equation and auxiliary data from the literature. At the melting point the calculated latent heats are 11,495 and 6,907 cal/mole for sublimation and vaporization, respectively. Extrapolations based upon data for the liquid indicate that Trouton's constant equals 21.79. (auth)

532

Carbide and Carbon Chemicals Co. (K-25)
THE MICROWAVE SPECTRUM AND STRUCTURE OF CHLORINE TRIFLUORIDE, by D. F. Smith. Issued Oct. 27, 1952. 14p. (K-940)

A microwave spectrometer designed for the study of the microwave spectra of corrosive fluorine compounds has been used to observe and measure a portion of the microwave spectrum of chlorine trifluoride. A number of transitions have been identified, and from these the moments of inertia and quadrupole coupling coefficients of both Cl^{35}F_3 and Cl^{37}F_3 have been obtained. An intensity alternation was observed showing that the ClF_3 molecule has a C_{2v} axis and is planar. The moments of inertia confirm this and further show that ClF_3 has a distorted "T" structure with one short (1.598 Å) and two long (1.698 Å) ClF bonds. The angle between the two different kinds of ClF bonds is $87^\circ 29'$. The quadrupole coupling coefficients $\chi_{aa}(\text{Cl}^{35}\text{F}_3) = -81.2$ Mc, $\chi_{bb}(\text{Cl}^{35}\text{F}_3) = -64.7$ Mc, $\chi_{cc}(\text{Cl}^{35}\text{F}_3) = -146$ Mc agree with the observed frequency $\nu(\text{Cl}^{35}\text{F}_3) = 75.1295$ Mc, of the pure quadrupole spectrum of ClF_3 , which corresponds to an eqQ of 150 Mc. (auth)

533

Carbide and Carbon Chemicals Co. (K-25)
THE VAPOR PRESSURE, ASSOCIATION, AND HEAT OF VAPORIZATION OF HYDROGEN FLUORIDE, by R. L. Jarry and W. Davis, Jr. Issued Oct. 9, 1952. 21p. (K-968)

The vapor pressure of hydrogen fluoride has been measured in a dynamic system, over the temperature range 0 to 105°C. Data have been fitted to the Antoine and Kirchhoff equations

$$\log_{10} P_{\text{mm}} = 8.38036 - \frac{1952.55}{335.52 + t} \quad (t = ^\circ\text{C}) \quad (1)$$

$$\log_{10} P_{\text{mm}} = -1.91173 - \frac{916.24}{T} + 3.21542 \log_{10} T, \quad (T = ^\circ\text{K}) \quad (2)$$

neither of which is preferred over the other on the basis of least-squares analysis. Association factors for the saturated vapor have been calculated from vapor density measurements. These factors range from 4.72 at 0°C to 2.42 at 105°C. Heats of vaporization have been calculated and a theoretical treatment developed to show heat terms for a heat of vaporization and the heat due to hydrogen bridge breakage. Data have also been expressed in terms of the number of hydrogen bridges per 20 g of hydrogen fluoride; only the limiting values of that quantity can be given. (auth)

534

Harvard Univ. School of Public Health
REMOVAL OF SOLUBLE GASES AND PARTICULATES FROM AIR STREAMS (With special reference to fluorides), by Edward M. Berly, Melvin W. First, and Leslie Silverman. Apr. 18, 1952. 48p. (NYO-1585)

High-efficiency absorption of soluble or reactive gases can be obtained with available equipment using wetted-fiber beds. Wetted fibers are 5 to 10 times more efficient than Raschig rings or Berl Saddles when compared on the basis of equal volumes. When compared on the basis of weight of packing, one pound of 78-micron-diameter Saran fibers are about 150 times more efficient for the absorption of HF gas than one pound of $\frac{1}{2}$ -inch Raschig rings. This reduction in weight and bulk can be utilized to realize important savings in construction and maintenance of gas-absorbing systems. A five-stage system of concurrently wetted fiber beds and countercurrent stages can produce 70% hydrofluoric acid from 19.8% HF gas and give a gaseous effluent which is hygienically safe. Scrubbing of lean gas concentrations for control of atmospheric pollution may be accomplished in one or, at most, two stages containing bed depths not greater than 4 inches. (auth)

535

Oklahoma Univ.
INFRARED AND RAMAN SPECTRA OF FLUORINATED ETHANES. VI. THE SERIES CF_3CH_3 , $\text{CF}_3\text{CH}_2\text{Cl}$, CF_3CHCl_2 , AND CF_3CCl_3 , by J. Rud Nielsen and C. Y. Liang, Oklahoma Univ. and D. C. Smith, Naval Research Lab. 26p. [nd] (ORO-82)

Methyl fluoroform and 1,1,1-trifluoro-2,2,2-trichloroethane, the first and last compounds of this series, have been studied previously. The infrared spectra of gaseous $\text{CF}_3\text{CH}_2\text{Cl}$ and CF_3CHCl_2 have now been obtained in the range 2 to 38 μ , and the spectra of the liquids in the range 2 to 22 μ , with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectra of these compounds in the liquid state have been photographed with a three-prism glass spectrograph of linear dispersion 15 Å/mm at 4358 Å. Depolarization ratios have been determined for most of the Raman bands. All fundamental vibration frequencies have been assigned and correlated with the fundamentals of CF_3CH_3 and CF_3CCl_3 , and thermodynamic properties have been calculated. (G.Y.)

536

THE SOLUBILITY OF WATER IN NORMAL PERFLUORO-HEPTANE. G. J. Rotariu, D. W. Fraga, and J. H. Hildebrand. *J. Am. Chem. Soc.* 74, 5783(1952) Nov. 20.

Mean values of 2.2 and 5.4 mg of $\text{H}_2\text{O}/100$ g of $n\text{-C}_7\text{F}_{16}$ were found at 25 and 50°C, respectively. An empirical solubility parameter is calculated and compared with parameters for H_2O in P_4 , CS_2 , and CCl_4 . (G.Y.)

537

THE MOLECULAR STRUCTURES OF OCTAFLUOROCYCLOBUTANE AND OF METHYLCYCLOBUTANE. H. P. Lemaire and R. L. Livingston. *J. Am. Chem. Soc.* 74, 5732-6(1952) Nov. 20.

The structures of octafluorocyclobutane and of methylcyclobutane have been investigated by electron diffraction using both the radial distribution and visual correlation methods. The results indicate that C_4F_8 has a non-planar carbon ring and the following parameters: $\text{C}-\text{F} = 1.33 \pm 0.02$ Å, $\text{C}-\text{C} = 1.60 \pm 0.04$ Å, $\angle\text{FCF} = 109.5 \pm 3^\circ$, α (the angle between planes which bisect opposite CF_2 groups) $= 160 \pm 4^\circ$; for such a model the $\text{C}-\text{C}-\text{C}$ angle is about 89° . In methylcyclobutane, the $\text{C}-\text{C}$ distance in the ring has been found to be 1.56 ± 0.03 Å and the average $\text{C}-\text{C}$ distance, 1.555 ± 0.02 Å. β , which is defined as the angle between the side chain bond

direction and the bisector of the adjoining C-C-C angle in the ring, is assigned the value $130 \pm 8^\circ$, corresponding to a C-C-CH₃ bond angle of approximately 118° . (auth)

GRAPHITE

538

THE STRUCTURE OF GRAPHITE OXIDE. R. J. Beckett and R. C. Croft. *J. Phys. Chem.* 56, 929-35(1952) Nov.

Difficulties relating to the determination of the structure of graphite oxide have been reviewed. Fresh evidence indicating the structural nature of this compound is presented. This was obtained from electron microscope studies of small particles of South Australian graphite and the oxide prepared from it. The latter exhibits considerable folding but the former does not. This difference is attributed to the redistribution of valency linkages between carbon atoms in the layer planes of graphite occurring when the latter is converted to graphite oxide. (auth)

LABORATORIES AND EQUIPMENT

539

Rensselaer Polytechnic Inst.

LIQUID-LIQUID EXTRACTION, by Peter Kisliak, Robert R. Reeves, Joel O. Hougen. Issued July 1, 1952. 73p. (SO-3501)

Two types of wetted surface apparatus were constructed for obtaining rate of transfer data in liquid-liquid systems. The first was similar in principle to the conventional wetted-wall devices used by many other investigators but was sufficiently short to be considered differential. The second consisted of a porous sphere supported in the fluid stream by which it was hoped to simulate conditions surrounding a droplet passing through a continuous phase. The data obtained are limited in extent because of experimental difficulties. The presence of contaminants was found to exert a profound influence on the results obtained. Measurements of the velocity of droplets under various conditions for a given system were obtained in a typical spray column. It was found that velocities vary from 50 to 150% of the mean velocity at a given set of conditions. A high degree of bulk mixing of the continuous phase was observed in spray columns giving rise to abrupt concentration changes in the region of the interface and higher-transfer coefficients within the column than predicted by terminal concentrations. Packing diminishes bulk mixing and permits higher concentration gradients to exist. In addition, packing increases dispersed-phase hold up, the over-all result being an increase in mass-transfer rates in such columns. (auth)

E40

Atomic Energy Project, Univ. of Calif., Los Angeles
A PARTITION CELL FOR THE SPINCO PREPARATORY ULTRACENTRIFUGE, by Ole Arne Schjeide and Reginald W. Dickinson. Issued Nov. 14, 1952. 7p. (UCLA-234)

A centrifuge tube composed of several plastic disks sealed together with stopcock grease has been constructed for use in the Spinco preparatory ultracentrifuge. A column of liquid can be partitioned into several different fractions by sliding these disks partially off one another. (auth)

541

A DEVICE FOR THE DECONTAMINATION OF BOTTLES WHICH HAVE HELD I¹³¹-CONTAINING URINE. W. J. Wingo. *Texas Repts. Biol. Med.* 10, 751-2(1952) Fall.

This rinsing device for the decontamination of bottles which have held I¹³¹-containing fluids is constructed of vertical tubes, leading from a water-supply manifold, over which the bottles may be inverted. (H.F.G.)

MOLECULAR STRUCTURE

542

Solid-State and Molecular Theory Group, Mass. Inst. of Tech.

QUARTERLY PROGRESS REPORT NO. 6. Oct. 15, 1952. 35p. (NP-4137; Quarterly Progress Report No. 6; U-24875)

Results are reported of studies of orthogonal atomic orbitals and covalent binding, theory of ferromagnetism, theory of molecular O₂ configuration interaction applied to the H molecule, a study of 2Z_p in atoms, and the acousto-electric effect. (cf. TIP U24244) (H.F.G.)

RADIATION CHEMISTRY

543

Brookhaven National Lab.

FRACTIONATION OF THE CARBON ISOTOPES IN DECARBOXYLATION REACTIONS. V. THE MECHANISM OF THE PYROLYSIS OF BARIUM ADIPATE, by Jacob Bigeleisen, Aksel A. Bothner-By, and Lewis Friedman. [nd] 12p. (BNL-1276)

A study of the fractionation of the carbon isotopes in the pyrolysis of barium adipate to form barium carbonate and cyclopentanone has been made. At 300°C the fractionation factor is less than a few tenths of a percent. In the pyrolysis of a mixture of barium adipate and BaC¹⁴O₃, all the C¹⁴ remains in the BaCO₃. These results are interpreted in terms of a mechanism which involves a rapid, reversible proton removal from an alpha carbon in the adipate ion, followed by a concerted decarboxylation and ring closure reaction. (auth)

544

Knolls Atomic Power Lab.

RADIATION CHEMISTRY DISCUSSIONS WITH DR. F. S. DANTON [ON] OCTOBER 8, 1952, by L. M. Dorfman and S. S. Jones. Oct. 20, 1952. 3p. (TID-5099)

Discussions held between KAPL personnel and Dr. F. S. Dainton of the University of Leeds, England, are briefly summarized. From the radiolysis-photolysis yield ratios for H₂O₂ solutions, the primary radiation yield for water was determined. The value was 13.4 water molecules dissociated per 100 ev. The post-irradiation effect in ferrous dosimeter solutions was studied. At large dose rates with dilute ferrous solutions, a large fraction of the Fe is oxidized after the γ radiation ceases. (L.T.W.)

545

EXCHANGE OF Br⁸⁰ ATOMS WITH BROMOOLEFINS; INDUCED REARRANGEMENT OF THE BROMOPROPENES. Russell R. Williams, Jr., William H. Hamill, Harold A. Schwarz, and Elliott J. Burrell. *J. Am. Chem. Soc.* 74, 5737-9(1952) Nov. 20.

It has been found that various bromoolefins, present to the extent of a few mole per cent in ethyl bromide or bromobenzene during neutron bombardment, undergo an efficient isotopic exchange reaction with the nascent Br⁸⁰. The ratio of the rates of such exchange with allyl bromide and α,β-dibromoethylene has been measured over a range of temperatures. In addition to the exchange an isomerization also occurs among the three bromopropenes. When one of these isomers is present during bombardment, and carrier amounts of the other isomers are added after bombardment, radioactive bromine may appear in all three components. Some suggestions concerning the mechanism of these reactions are offered. (auth)

RADIATION EFFECTS

546

THE INACTIVATION OF BACTERIOPHAGE AND CATALASE BY SOFT X-RAYS. W. R. Guild. *Arch. Biochem. Biophys.* 40, 402-15(1952) Oct.

An x-ray tube has been constructed in which the samples to be irradiated are placed inside the vacuum system. The voltage dependence of the inactivation rate of T-1 bacteriophage and catalase has been studied in the region 1500 to 4100 v in an attempt to find an effect as the K absorption edge of P was passed. The curves for T-1, containing 5% P, and catalase, with no P, are identical within experimental error, indicating that to within a factor of four the absorption of a photon by a P atom in nucleic acid is no more effective for inactivation of T-1 than absorption by any other atom. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

547

COMPLEXES OF VARIOUS METALS WITH ETHYLENE-DIAMINETETRAACETIC ACID. Arthur E. Martell and Robert C. Plumb. *J. Phys. Chem.* 56, 993-6(1952) Nov.

In a recent article (Plumb et al., *J. Phys. Chem.* 54, 1208(1950)) the relative tendencies of various transition metals to form complexes with ethylenediaminetetraacetic acid (EDTA) in a number of buffer solutions was reported. In the present paper the interpretation of the results is extended, and new data are presented for a number of rare earth ions. (auth)

SEPARATION PROCEDURES

548

Oak Ridge National Lab.
QUANTITY SEPARATION OF RARE EARTHS BY LIQUID-LIQUID EXTRACTION. I. THE FIRST KILOGRAM OF GADOLINIUM OXIDE, by Boyd Weaver, F. A. Kappelmann, and A. C. Topp. Oct. 22, 1952. 25p. (ORNL-1408)

Countercurrent liquid-liquid extraction techniques have been successfully applied to the separation of large quantities of rare earths—specifically for the purification of gadolinium. The solvents used were *n*-tributyl phosphate and nitric acid. More than a kilogram of better than 95% gadolinium oxide has been produced. Increases in temperature have been found to decrease extraction into the organic phase. Distribution coefficients of rare earths between freshly prepared tributyl phosphate and nitric acid are nearly independent of rare earth concentration within the practical operating range. (auth)

549

Oak Ridge National Lab.
LIQUID-LIQUID EXTRACTION OF NEODYMIUM AND SAMARIUM NITRATES, by A. C. Topp. Sept. 26, 1952. 16p. (ORNL-1409)

A preliminary study has been made of the distribution of neodymium and samarium nitrates between 12*N* nitric acid and tributyl phosphate diluted with Varsol. There is a nearly constant separation factor 2.8 between these two elements. Distribution coefficients are dependent upon temperature but not upon rare earth concentration. The use of the solvent in an extraction column increases distribution coefficients by a definite amount. Attempts to determine the mechanism have been unsuccessful. (auth)

ADSORPTION PHENOMENA

550

THE ADSORPTION OF COBALT AND BARIUM IONS BY HYDROUS FERRIC OXIDE AT EQUILIBRIUM. J. E. Duval and M. H. Kurbatov. *J. Phys. Chem.* 56, 982-4(1952) Nov.

A study of the adsorption of Ba and Co ions in quantities less than 10^{-8} gram atom per 30 ml of solution was pursued with the purpose of effecting the separation of these elements as they appear in radioactive forms after activation of stable isotopes or in fission and spallation nuclear reactions. The behavior of these divalent ions in such extreme

dilution, with respect to adsorption phenomena at equilibrium, was investigated in order to verify the previously derived adsorption equation. It was found that under comparable conditions Co is adsorbed to a greater extent than Ba the ratio of the two being as high as four in some cases shown. The amount of Co or Ba adsorbed at equilibrium increases with pH and quantity of adsorbent in a manner consistent with the law of mass action, when the pH of the solution is above 6.5 to 7.0. At pH less than 6.5 to 7.0 the adsorption of Co is greater than expected from the simplified mass law equation, in which the effect of anions, such as chloride, is considered constant. Ba and Co ions which occur together in low concentration in fission products can be separated from one another only partially by adsorption on hydrous ferric oxide. (auth)

SPECTROSCOPY

551

Argonne National Lab.
ABSORPTION BANDS AND LINES IN IRRADIATED LiF, by Charles Delbecq and Peter Pringsheim. Sept. 22, 1952. 28p. (AECU-2307; UAC-652)

Structures and spectral assignments of several absorption lines and bands of LiF crystals are discussed on the basis of changes produced by x and ultraviolet irradiations at various temperatures. (G.Y.)

SYNTHESES

552

Atomic Energy Research Establishment, Harwell, Berks (England)

QUATERNARY AMMONIUM NITRATES. PART I. PREPARATION FROM ALKYL NITRATES AND α - ω -POLYMETHYLENE DINITRATES, by E. S. Lane. Aug. 15, 1952. 8p. (AERE C/R 995)

Good yields of quaternary ammonium nitrates are produced by quaternization of tertiary bases with alkyl nitrates. The reaction has been successfully extended to the production of polymethylene bis (quaternary ammonium nitrates) and of isothiurea dinitrates. Some general features of the reaction are discussed. (auth)

553

Chemical Research Lab., Metal Hydrides, Inc.
THIRD TOPICAL REPORT [ON] APPRAISAL OF THE WEICHSSELFELDER METHOD FOR PREPARATION OF IRON AND NICKEL HYDRIDES, by M. Douglas Banus and Thomas R. P. Gibb, Jr. July 31, 1950. 15p. (NEPA-1550)

554

MICRO SYNTHESIS WITH TRACER ELEMENTS. IX. THE SYNTHESIS OF ETHYLENEDIAMINE TETRA-(2-C¹⁴-ACETIC) ACID. Arthur Murray, III, and Anthony R. Ronzio. *J. Am. Pharm. Assoc. Sci. Ed.* 41, 596-7(1952) Nov.

A method is described which proved satisfactory for the micro synthesis of 2-C¹⁴-labeled (ethylenediamine)tetraacetic acid. (C.R.)

TRACER APPLICATIONS

555

Brookhaven National Lab.
THE THERMAL DECOMPOSITION OF NITROUS OXIDE, by Lewis Friedman and Jacob Bigeleisen. [nd] 8p. (BNL-1282)

An abstract of this report was indexed as report AECU-969 and appears in Nuclear Science Abstracts as NSA 4-6593.

TRITIUM AND TRITIUM COMPOUNDS

556

TRITIATION OF MULTIPLE BONDS; SYNTHESIS OF TRITIATED STYRENE. Irving A. Bernstein, Winifred Bennett,

and Melvin Fields. *J. Am. Chem. Soc.* **74**, 5763-4(1952) Nov. 20.

T-labeled styrene has been prepared by the reduction of acetophenone with T and subsequent dehydration of the methyl phenyl carbinol. The reduction was carried out at room temperature and atmospheric pressure over Pt oxide. Dehydration of the carbinol in the presence of p-toluenesulfonic acid gave a 79% yield of styrene of specific activity 0.66 mc/millimole. (G.Y.)

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

557

Lewis Flight Propulsion Lab., NACA
FLOW SURFACES IN ROTATING AXIAL-FLOW PASSAGES, by John D. Stanitz and Gaylord O. Ellis. Nov. 1952. 31p. (NACA-TN-2834)

In order to investigate the deviation of flow surfaces from their assumed orientation in the usual type of two-dimensional solution, three-dimensional, incompressible, nonviscous, absolute irrotational fluid motion is determined for flow through rotating axial-flow passages bounded by straight blades of finite spacing and infinite axial length lying on meridional planes. Solutions are obtained for five passages with varying blade spacing and hub-tip ratio. The results are presented in such a manner as to apply for all ratios of axial velocity to passage tip speed. It is concluded that, for conditions in typical axial-flow blade rows, the deviation of flow surfaces from their assumed orientation in two-dimensional solutions is small. (auth)

558

Lewis Flight Propulsion Lab., NACA
EFFECT OF CHANGING PASSAGE CONFIGURATION ON INTERNAL-FLOW CHARACTERISTICS OF A 48-INCH CENTRIFUGAL COMPRESSOR. II-CHANGE IN HUB SHAPE, by John Mizisin and Donald J. Michel. Nov. 1952. 35p. (NACA-TN-2835)

The passage contour of a 48-inch centrifugal compressor was modified by changing the shape of the hub to control the deceleration rates along the blade of the impeller. A comparison of internal-flow characteristics at design flow rate was made with the original impeller and with a modified-blade impeller that had the same area variation in the passage. In addition, flow characteristics of the modified-hub impeller over a flow range from maximum flow to near surge at a corrected tip speed of 700 feet per second are presented. At design flow, even though the deceleration rate along the trailing face was less for the modified-hub impeller than for the original impeller, the clearance losses (increased by the larger ratio of clearance to passage height) caused the total-pressure losses (and thus the relative adiabatic efficiency) to be about the same at the impeller exit for the two configurations, thus precluding any improvement in over-all performance. As in the original modified-blade impellers, large losses occurred at the driving-face inlet at negative angles of attack and in regions of large decelerations along the trailing-face flow surface. (NACA)

559

NEPA Div., Fairchild Engine and Airplane Corp.
AN APPROXIMATE METHOD FOR ESTIMATING THE TOTAL-PRESSURE LOSS FOR FLOW OF AIR THROUGH TUBES WITH HEATING AND FRICTION; AIRPLANE DESIGN SECTION MEMORANDUM TECHNICAL REPORT NO. DR-1, by M. L. Lesser. June 1947. 23p. (NEPA-249; DR-1)

550

Norman Bridge Lab., Calif. Inst. of Tech.
THEORY OF HEAT AND MASS TRANSFER FROM A SLOWLY MOVING SPHERE TO THE SURROUNDING MEDIUM, by Leo Breiman. Sept. 20, 1952. 16p. (NP-4129; Report No. 27-2)

The method described uses a Green's function to convert the differential equation of the problem into an equivalent integral equation which is then solved by iteration. The heat transfer given by the second iteration is computed, and the convergence rate of the iteration is discussed. A few remarks are made about the nature of the solution and the numerical results following from it. (L.T.W.)

561

VISCOSITY OF STEAM IN REGARD TO PRESSURE. N. B. Vargaftik. *Izvest. Vsesoyuz. Teplotekh. Inst. im. Feliksa Dzerzhinskogo* **21**, 13-17(1952) Jan. (In Russian)

The author reviews existing charts and equations for the viscosity of steam and concludes that no equation has been found until now for the practically precise determination of steam viscosity over the complete range of pressures and temperatures given in contemporary charts of steam, i.e., to 300 atm and 600°C. The author develops an equation and applies it to composing a chart of steam viscosity, and also discusses the viscosity of water. (G.Y.)

MATERIALS TESTING

562

Applied Science Research Lab., Univ. of Cincinnati
PROGRESS REPORT NO. 1 FOR JULY 1, 1951-OCTOBER 1, 1951 ON A STUDY OF POROUS MEDIA BY MEANS OF FLOW METHODS, by John Ross and Gerard Kraus. Oct. 3, 1951. 14p. (NP-4204; Progress Report No. 1)

A study is made of the application of the theory of flow of gases through porous media for measurement of the internal surface area of porous materials. An apparatus was designed to allow steady-state flow rates to be measured at mean pressures ranging from atmospheric pressure down to a few millimeters of Hg. (J.E.D.)

MINERALOGY, METALLURGY, AND CERAMICS

563

Richards Mineral Engineering Lab., Mass. Inst. of Tech.
THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS; PROGRESS REPORT. Oct. 31, 1952. 49p. (NYO-3671; MITS-17)

Radioisotopes of Ca and Na were used to measure the difference in adsorption of Ca and Na on pyrite. The effect of dissolved O₂, Ca and Na concentration, H⁺ concentration, and anions on the adsorption was evaluated. Impact tests were conducted to record the shock waves in impacted solids. The adsorption of octadecylammonium acetate on quartz was studied. Zeta potentials of quartz in mixtures of electrolytes were investigated, and a study was made of the effect of Na laurate on Ba-activated quartz. The diffusion equation for Na diffusing into a single crystal of oligoclase was solved. The effect of varying sulfate concentration on the adsorption of Fe₂(SO₄)₃ complexes by the sulfate form of Amberlite IRA-410 was determined at a pH of 3 and a constant Fe concentration of 1.25 g/l. Data on the adsorption of xanthate on pyrite are reported. (L.T.W.)

CERAMICS AND REFRACTORIES

564

Argonne National Lab.

REFRACTORY OXIDE MELTING POINTS, by Wingate A. Lambertson and Fred H. Gunzel, Jr. Oct. 22, 1952. Decl. Nov. 28, 1952. 4p. (AECD-3465)

The melting points of the following oxides were determined and checked: Al_2O_3 , $2034 \pm 16^\circ\text{C}$; La_2O_3 , $2210 \pm 20^\circ\text{C}$; Nd_2O_3 , $2272 \pm 20^\circ\text{C}$; ZrO_2 , $2710 \pm 15^\circ\text{C}$; UO_2 , $2878 \pm 22^\circ\text{C}$; and ThO_2 , $3220 \pm 50^\circ\text{C}$. (auth)

565

New York State Coll. of Ceramics, Alfred Univ.

EVALUATION TECHNIQUES FOR HIGH TEMPERATURES METAL-CERAMIC MATERIALS, by W. B. Crandall and M. A. Tuttle. Sept. 15, 1952. 27p. (NP-4135; U-24706)

The following criteria were established for metal-ceramic mixtures: relatively high m.p.'s (1500°C for metals, 1800°C for ceramics), high oxidation resistance, compatible crystal structure, freedom from undesirable physical-chemical reaction tendencies during operations, and high thermal-shock resistance. Experiments were conducted on systems containing Co, Ni, Cr, Fe, Be, and Zr metals; Al, Mg, Zr, Cr, and Be oxides; the metalloids SiN, TiN, ZrC, ZrB_2 , and TiB_2 ; and the aluminides of Cr, Mo, and Ni. The rate of change of O concentration in the pores of a cermet body appears to control the progress of oxidation; as porosity decreases, grain-boundary diffusion of O and of metal ions probably becomes more significant. A temporary procedure is described for evaluating the oxidation resistance of cermets with respect to an SiC body. Phase studies were made of the systems in the fired and unfired states. Methods were devised for measuring thermal diffusivity by an unsteady-state procedure based on a radiation-boundary condition in which experimental heating curves are compared with the simplified solution of the heat-conduction equation; thermal expansion by a sensitive gage which employs 2 parallel-line gratings; the effect of initial particle size on tensile strength; and thermal shock calculated from the thermoelastic equation based on the principle of minimum potential energy. (auth)

CORROSION

566

North American Aviation, Inc.

MOLYBDENUM CORROSION BY SODIUM, by R. Cygan and E. Reed. Issued Nov. 20, 1951. Decl. with deletions Dec. 1, 1952. 15p. (AECD-3473; NAA-SR-161)

Investigations of corrosion with both liquid Na and Na vapor, carried out at low temperatures, have shown Mo to be one of the most promising of the refractory metals. This report gives the results of the first corrosion test on Mo in Na vapor at 1500°C that has been successfully completed. In addition to the usual grain growth, the Mo showed some intergranular-type attack with a maximum penetration of less than 1 mil. (auth)

GEOLOGY AND MINERALOGY

567

Geological Survey

URANIUM-BEARING COAL AND CARBONACEOUS ROCKS IN THE FALL CREEK AREA, BONNEVILLE COUNTY, IDAHO, by James D. Vine and George W. Moore. 1952. 10p., 1 illus. (GS-C-212)

Uraniferous coal, carbonaceous shale, and carbonaceous limestone occur in the Bear River formation of Early Cretaceous age at the Fall Creek prospect, in the Fall Creek area, Bonneville County, Idaho. The uranium compounds are believed to have been derived from mildly radioactive

silicic volcanic rocks of Tertiary age that rest unconformably on all older rocks and once overlay the Bear River formation and its coal. Meteoric water, percolating downward through the silicic volcanic rocks and into the older rocks along joints and faults, is believed to have brought the uranium compounds into contact with the coal and carbonaceous rocks in which the uranium was absorbed. (auth)

568

Division of Raw Materials, AEC

PRACTICAL GUIDES TO URANIUM ORES ON THE COLORADO PLATEAU, by E. V. Reinhardt. Issued Sept. 30, 1952. 13p. (RMO-1027)

This report is presented as an aid to geologists working with core from diamond-drill holes and to prospectors. It is noted that the sedimentary guides in the first group have no application except in areas which are known, for other reasons, to be mineralized. The second group, related to the mineralizing solutions, has a wider utility for the prospector, and is as useful to geologists directing exploratory drilling as the first group of sedimentary guides. (J.E.D.)

569

Geological Survey

TRACE ELEMENTS RESEARCH QUARTERLY PROGRESS REPORT [FOR] JANUARY 1 TO MARCH 31, 1952. 63p. (TEI-270(pt.1))

An attempt is made to correlate the past and present ground-water conditions with distribution and age determinations of the ore bodies to resolve the problem of the source and time of deposition of the Colorado Plateau U and V ores. Resistivity depth measurements are discussed as a means of determining the sedimentary structures in the upper part of the Salt Wash sandstone member of the Morrison formation. In all the rocks studied, from the rich phosphate zones in Wyoming, Idaho, and Montana, the phosphate mineral was found to be carbonate-fluorapatite as in Florida. The surface material and topography is found to reflect the character of the underlying Hawthorn formation of Miocene age in Florida. A study of the distribution and origin of the Rn and He in the Panhandle gas field, Texas, indicates that matching of permeability profiles may yield clues as to the sedimentary and structural conditions. Isotope analysis of a galena crystal showed a substantial variance in the relative abundance of radiogenic isotopes in progressing from the center outward. It is concluded from a study of the differential leaching of uranium, radium, and lead from pitchblende that a relative enrichment in both radium and lead results from leaching of U from oxidized pitchblende in H_2SO_4 solutions. In the investigation of metamict minerals, "high-temperature fergusonite" has been synthesized from a dry melt and is apparently identical with heated (about 850°C) metamict fergusonite. Even though melting did not take place, there was complete chemical reaction to form the Y niobate from the constituent oxides. It has been observed in the course of the studies of metamict minerals that many of the recrystallized metamict minerals show minor differences in their d-spacings from specimen to specimen that probably reflect differences in chemical composition. (H.F.G.)

570

Geological Survey

A NOMOGRAM FOR OBTAINING PERCENT COMPOSITION BY WEIGHT FROM MINERAL-GRAIN COUNTS, by Robert Berman. Oct. 1952. 8p. (TEI-273)

A nomogram for calculating percent composition from mineral-grain counts reduces several of the more tedious arithmetical operations to two mechanical ones. (auth)

571

Geological Survey

SPECTROGRAPHIC IDENTIFICATION OF MINERAL

GRAINS, by J. N. Stich. Oct. 1952. 41p. (TEI-274)

A qualitative spectrographic method of analysis of single mineral grains, impurity inclusions, x-ray powder spindles, and other small samples weighing 1 mg or less is described. Samples weighing as little as 0.01 mg have been analyzed. When 1 mg of sample is available, the accuracy of the method approaches that of a semiquantitative method. During a 10-month period, 20,000 determinations of 69 metallic and metalloid elements in more than 300 small samples have been made with the method. In conjunction with petrographic, physical, and x-ray methods, these determinations of chemical composition have been useful in establishing the mineral identity of small single grains. A d-c arc is used. The use of a standardization solution that includes only one element per plate greatly facilitates the selection of reliable analytical lines. A small carbon electrode cut from graphite stock $\frac{1}{8}$ -in. in diameter is used; this is convenient for the loading and arcing of x-ray powder spindles. The medium-size quartz-prism spectrograph is preferable to a grating instrument for qualitative microanalysis, as its complete spectrum coverage for a single exposure includes the most sensitive lines of the alkali elements. (auth)

572

Geological Survey

RECONNAISSANCE FOR URANIUM-BEARING CARBONACEOUS ROCKS IN NORTHWESTERN COLORADO, SOUTHWESTERN WYOMING, AND ADJACENT PARTS OF UTAH AND IDAHO, by James D. Vine and George W. Moore. Oct. 1952. 25p. (TEI-281)

During parts of July, Aug., and Sept., 1951, a reconnaissance was conducted in parts of Colorado, Wyoming, Utah, and Idaho in search of new deposits of U-bearing carbonaceous rocks. One significant U deposit was found—the Fall Creek deposit, in Bonneville County, Idaho. Several additional localities were discovered where the concentrations of U are many times the concentration normally found in carbonaceous rocks. (auth)

573

REACTIONS IN THE INTERIOR OF THE LAYER LATTICE OF URANITES. Armin Weiss and Ulrich Hofmann. *Z. Naturforsch.* b7, 362-3(1952) June. (In German)

The natural and synthetic uranites, such as autunite and torbernite, which can be expressed by the formula $M(H_2O)_n(UO_2XO_4)$, where M is an exchangeable cation and $X = P, As, \text{ or } V$, have a layer structure, the $M(H_2O)_n$ forming one layer and the UO_2XO_4 a second. Reduction of the layer separation changes the water content, and the water can be replaced by polar organic liquids, such as glycerin or ethylene glycol. An intercrystalline imbibition similar to that in batavite is indicated. Changes in layer separation and color on inclusion of various aromatic amines and dye stuffs are discussed. (G.Y.)

574

RADIOACTIVE MEASUREMENTS IN GEOLOGY. I. NUCLEAR PHYSICS FUNDAMENTALS. H. v. Buttlar and I. Wendt. *Arch. tech. Messen*, 225-8(1952) Oct. (In German)

Some elementary aspects of radioactive decay, natural decay series, and penetration of radiation through matter are presented preliminary to a description of their applications to geological problems. 22 references. (G.Y.)

575

HOW INDUCED RADIOACTIVITY MAY HELP SEPARATE MINERALS. A. M. Gaudin, F. E. Senftle, and W. L. Freyberger. *Eng. Mining J.* 153, No. 11, 95-9, 174, 176 (1952) Nov.

Since minerals in nature contain impurities, calculation of expected neutron-induced activity on the basis of chemical composition is not accurate. In order to gain direct knowl-

edge of this behavior of minerals, an extensive series of tests was run at the Brookhaven National Lab., using the nuclear reactor as a neutron source and measuring the induced β and γ activities. One hundred and fifty specimens of 51 mineral species were studied. For each mineral the observed activity was compared with a calculated value for the appropriate pure chemical compound. As might be expected, minerals containing Cu, Ag, Mn, and Al gave the highest activities. Many combinations of minerals were found to have activity differences that should make an activity-controlled mechanical separation feasible. In general, the measured activity was higher than the calculated activity. Selective detection based on different rates of decay were not realized for different minerals out of the same ore body, possibly because the minerals contain the same principal elements and/or impurities even though in different proportions. A cheap, simple source of neutrons with a flux of about 10^9 n/cm²/sec would be required for successful application. (G.Y.)

576

BALNEOLOGY; ON THE PRESENT CONDITION OF RADIUM HEALTH BATHS IN THE WEST ZONE OF GERMANY. C. Genser. *Munch. med. Wochschr.* 94, 2066-72(1952) Oct. 10. (In German)

Ra and Rn contents and other properties of various hot springs in the West Zone of Germany are compared with those of several springs in the East Zone. (G.Y.)

METALS AND METALLURGY

577

Argonne National Lab.

THE ANODIZING OF ZIRCONIUM AND OTHER TRANSITION METALS IN NITRIC ACID, by R. D. Misch and W. E. Ruther. Oct. 1952. 22p. (AECU-2310; UAC-655)

Zirconium was anodized in solutions of nitric acid and compared with certain other transition metals. At 1 ma/cm² zirconium was found to develop a low-resistance oxide layer at concentrations of nitric acid exceeding 14 wt.%. Titanium, hafnium, niobium, tantalum, and tungsten showed a high resistance at this current even in 70% acid. Hafnium, however, produced a low-resistance film at lower current densities. Zirconium showed periodic changes of resistance with time in nitric acid above 14 wt.%. It is postulated that nitric acid promotes the nucleation of oxide grains favoring permeation of electrolyte along grain boundaries. It is also suggested that a favorable orientation of oxide on metal is responsible for the ease of nucleation of oxide on zirconium and hafnium in contrast to the other metals. The diffusion of oxygen inward is believed to be the mechanism of film growth at the metal-oxide interface. (auth)

578

Armour Research Foundation

DETERMINATION OF PHYSICAL PROPERTIES OF NON-FERROUS STRUCTURAL SHEET MATERIALS AT ELEVATED TEMPERATURES, by D. D. Doerr. Dec. 1951. 215p. (AF-TR-6517(pt.1))

Compressive, bearing, and shear properties were determined for various nonferrous materials to establish aircraft design criteria and to investigate a possible correlation of these properties with the results of elevated-temperature tensile tests. The materials and test conditions were: (1) 24S-T3 Al alloy, room temperature and 212 to 700°F for exposure periods of 0.5 to 1000 hr; (2) 75S-T6 Al alloy and FS-1H and MH Mg alloys, room temperature and 300 to 600°F for 0.5 to 1000 hr; and (3) annealed and cold-rolled Ti materials, room temperature and 400 to 1000°F for 0.5 to 100 hr. Before each elevated-temperature test, a survey was made of the temperature distribution throughout a dummy

specimen heated in the test furnace. Tensile, compressive, and bearing-yield stresses decreased with increasing temperature and exposure time. The modulus of elasticity in tension and in compression decreased with increasing temperature above room temperature but appeared essentially independent of exposure time. At any temperature, the ratio $E_{\text{temp}}/E_{\text{RT}}$ in compression and in tension was essentially the same for all materials except the annealed Ti. Apparently these physical properties cannot be predicted accurately over extensive temperature ranges by simple calculations. (TID-LC)

579

NEPA Div., Fairchild Engine and Airplane Corp.

BEAM THEORY FOR BENDING OF BARS UNDER CREEPING CONDITIONS, by W. Kenneth Bodger. Apr. 1951. 66p. (NEPA-1850)

580

Wright Aeronautical Corp.

FINAL REPORT ON WORK ACCOMPLISHED ON ITEM 1, AMENDMENT NO. 3, EXHIBIT B OF N.E.P.A. CONTRACT NO. SC-2015, by W. M. Boom. Apr. 23, 1951. 35p. (NEPA-1854; W.A.C. Serial Report No. 1523)

Satisfactory welds can be made on 0.009, 0.030, and 0.062-in. pure molybdenum sheet using the inert-gas-shielded tungsten arc. Preheating was not necessary to obtain crack-free welds in the subject material. Moderate ductility was obtained on room-temperature bend tests. Good ductility was obtained by heating above 400°F. (auth)

581

California Inst. of Tech.

PREYIELD PLASTIC AND ANELASTIC MICROSTRAIN IN LOW-CARBON STEEL; SIXTH TECHNICAL REPORT, by T. Vreeland, Jr., D. S. Wood, and D. S. Clark. Sept. 1952. 28p. (NP-4127)

Annealed low-C steel specimens were subjected to rapidly applied constant stresses which were less than the static upper-yield stress of 0.04 psi. A record of load and microstrain was made continuously for 3.5 sec and then at intervals for about 5 min until the microstrain reached an equilibrium value. These data provided for a quantitative evaluation of a Frank-Read dislocation-generating mechanism (Phys. Rev. 79, 727 (1950)). The characteristic length of dislocation determined by comparison of the theory and data agreed with previous concepts of a mosaic-block structure. The total microstrain produced by stresses less than yield was a function of the stress and increased from zero at a stress about 0.4 times that at yield to about 30×10^{-6} in./in. at the yield stress. Derivations and methods of correlating data are given, and other mechanism theories are discussed. (cf. TIP U21498) (TID-LC)

582

Institute of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF DISPERSIONS OF CuAl_2 ON THE ELEVATED TEMPERATURE TENSILE PROPERTIES OF Al-Cu ALLOYS; TWENTIETH TECHNICAL REPORT, by C. D. Starr, R. B. Shaw and J. E. Dorn. Sept. 15, 1952. 23p. (NP-4138; U-24757; Technical Report No. 20)

Alloys consisting of random dispersions of CuAl_2 particles in an α solid solution of 0.19 at.% Cu in Al were more resistant to plastic deformation than the α solid solution between 295 and 700°K. At low temperatures where recovery is insignificant and at high temperatures where recovery is more rapid than strain hardening, the increase in tensile properties was a function of the fineness of the dispersion. The slightly increased strength of the coarser over the finer dispersions in the intermediate range from about 450 to 620°K was attributed to the slower recovery rates of the coarser dispersions. Below 450 and above 620°K, the finer dispersions had a superior flow stress. (TID-LC) (cf. TIP U21997)

583

New York Univ.

INTERIM TECHNICAL REPORT NO. 2 [ON] THE QUENCH HARDENING OF TITANIUM-MANGANESE ALLOYS, by Y. C. Liu and H. Margolin. June 25, 1952. 20p. (NP-4180; Interim Technical Report No. 2; WAL-401/88-15)

Investigation of the habit plane in Ti-Mn alloys was carried out in the range of manganese contents between 4.35 and 5.25%. On the basis of 22 measurements, the poles were observed to fall into two groups, indicating the existence of two habit planes. The Miller indices of these two planes have been determined. Above 5.25% Mn, the high-temperature phase is retained on water quenching from the beta field. A nominal 3% Mn specimen yielded a Laue photogram with spots so broadened that its orientation could not be determined. A variety of martensitic structures was observed and correlation between microstructures and habit plane has been made in some cases. Two habit planes were found in Ti-Mn alloys after water quenching from 1200°C. They are located close to the $\langle 344 \rangle$ and $\langle 334 \rangle$ poles. The existence of these two habit planes is apparently not composition dependent. It is very likely that a two-shear mechanism is operative in the formation of the martensitic structure. (auth)

584

Battelle Memorial Inst.

FINAL TECHNICAL REPORT ON SURFACE HARDENING OF TITANIUM BY CARBURIZING AND INDUCTION HEAT TREATING COVERING THE PERIOD AUGUST 1, 1951 TO AUGUST 31, 1952, by A. J. Griest, P. E. Moorhead, W. M. Parris, P. D. Frost, and J. H. Jackson. Aug. 31, 1952. 67p. (NP-4198)

Surface-hardening Ti alloys in order to improve wear resistance and to lessen tendency to gall and seize was studied. The methods considered were pack carburizing with a commercial compound and with C black, gas carburizing with propane-argon mixtures, and liquid carburizing with NaCN baths, and induction heat treatments. (J.E.D.)

585

Notre Dame Univ.

CONTRACTOR'S TECHNICAL REPORT NO. 1 [ON] ORDER-DISORDER TRANSFORMATIONS IN METALLIC ALLOYS FOR THE PERIOD OCT. 17, 1952 TO NOV. 17, 1952, by G. C. Kuczynski. Nov. 17, 1952. 4p. (NP-4216)

Electric conductivity measurements on AuCu and AuCu₃ relating to order-disorder transformations are reported briefly. A possible theory of ordering based entirely on diffusion is outlined. (L.T.W.)

88

Columbia Univ. School of Mines

PROGRESS REPORT NO. 2 [ON] ELECTROLYTIC PRODUCTION OF ZIRCONIUM METAL, by H. H. Kellogg, J. T. Benedict, and L. J. Howell. Aug. 31, 1952. 22p. (NYO-3107)

Preliminary experiments on the phase diagram and vapor pressure of melts in the system ZrCl_4 -NaCl are described. The design of equipment for electrolytic-conductivity, phase-diagram, and vapor-pressure measurements on fused melts containing ZrCl_4 is described. (auth)

587

General Electric Research Lab.

FIFTEENTH QUARTERLY REPORT [ON] FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; PROGRESS REPORT NUMBER 32, by J. H. Hollomon and D. Turnbull. Oct. 5, 1952. 6p. (SO-2024; Progress Report Number 32; RL-766)

The effect of 4 at.% dissolved Cu on the rate of self-diffusion of Ag is shown to increase D_0 by a factor of 1.5 without preceptibly affecting the activation energy. Proof

is given that the Bunsen calorimeter, used to measure high-temperature heat capacities, may be used to measure heats of wetting with satisfactory accuracy. The heat capacities of antimony and bismuth for the temperature range from 12 to 90°K have been measured. It was demonstrated that the simple Debye theory does not describe the data satisfactorily. In order to obtain a satisfactory description, it is necessary to take into account the "layer-like" nature of the structure. (auth)

582

STRESS-RUPTURE CHARACTERISTICS OF UNALLOYED TITANIUM PLOTTED. F. B. Cuff, Jr. and N. J. Grant. *Iron Age* 170, No. 21, 134-9(1952) Nov. 20.

The creep-rupture behavior of annealed Ti in air is complex. The effects of surface treatments and test atmosphere are important especially in small cross section test bars due in part to alloying of the Ti with O and N. The relative contributions to the strength of such alloying and from grain growth are not fully known. Such surface reactions tend to improve the rupture life performance of Ti at temperatures greater than about 900 or 1000°F. There is a sharp loss of strength as Ti passes through the equi-cohesive temperature. For 75A Ti the equi-cohesive temperatures vary from 720°F for a 100 hr rupture life to 1020°F for a rupture life of 0.1 hr. Ti undergoes a strain-aging behavior in hot tensile testing around 200 to 400°F. 12 figures. (auth)

TRACER APPLICATIONS

589

THEORETICAL PROBLEMS RELATED TO DETERMINATION OF THE COEFFICIENTS OF SELF-DIFFUSION IN SOLIDS BY THE METHOD OF HETEROGENEOUS ISOTOPIC EXCHANGE. Gaston Berthier. *J. chim. phys.* 49, 527-36 (1952) Oct. (In French)

Employment of the method of heterogeneous isotopic exchange for determination of coefficients of self-diffusion requires explicit knowledge of the equations representing the kinetics of the phenomenon used. These equations are given in the form of numerical tables permitting convenient evaluation of coefficients of self-diffusion. Applications to Ag_2S , S, and Hg are discussed. (tr-auth)

590

THE CARBON 14 METHOD OF AGE DETERMINATION. J. Laurence Kulp. *Sci. Monthly* 75, 259-67(1952) Nov.

Some of the numerous problems of archaeology, geology, ocean circulation, etc. solved by the C^{14} dating technique, which is illustrated, are summarized. 7 figures. 12 references. (G.Y.)

PHYSICS

591

Los Alamos Scientific Lab.

LUMINESCENCE BEHAVIOR IN TRITIUM OXIDE, by W. M. Jones. [nd] 5p. (AECU-2289; LADC-1269)

Preliminary observations on solid T_2O luminescence due to tritium radioactivity are reported. Specimens prepared by two methods are compared. Spectra recorded on photographic plates using slit widths down to 0.125 mm were in approximate agreement with more precise monochromator data and suggest a continuous spectrum. (C.R.)

592

Brookhaven National Lab.

DOUBLE FOCUSING OF CHARGED PARTICLES BY A SYSTEM OF TWO MAGNETS WITH NON-UNIFORM FIELDS, by R. M. Sternheimer. [nd] 36p. (BNL-1275)

Equations are obtained for the focusing by a system of two magnets with non-uniform fields such that $n > 0$ in the first magnet and $n < 0$ in the second. This system has been proposed by Courant, Livingston and Snyder. For each magnet a lens equation is set up and then the system of the two magnets is itself treated as a thick lens. It is shown that for very large n , there is, in general, one object distance for which double focusing takes place. The theory is also applied to deflecting systems with moderate values of n and it is shown that the entrance and exit angles can be reduced to values of the order of 20° even for small deflections (20°) of the charged particle. (auth)

593

Ames Lab.

QUARTERLY SUMMARY RESEARCH REPORT IN PHYSICS FOR APRIL, MAY AND JUNE 1952. Sept. 20, 1952. 25p. (ISC-283)

Progress is briefly reported on the following studies: atomic electron ejection in large-angle scattering of μ mesons, photoproton angular correlations, thermal conductivity of Th, Hall coefficient of Th, Hall coefficient of sodium tungsten bronze (Na_xWO_3), heat of vaporization of Nd, and physical properties of Gd. (L.T.W.)

594

Purdue Research Foundation

ADIABATIC HALL EFFECT IN SEMICONDUCTORS, by V. A. Johnson and F. M. Shipley. Aug. 1952. 119p. (NP-4128)

The adiabatic Hall coefficient R_a differs from the isothermal Hall coefficient R_I in that zero heat flow rather than zero temperature gradient parallel to the Hall electric field is assumed. The theoretical expression involves integrals which depend upon the distribution function for the conduction-electron velocities, and upon the energy dependence of the electron mean free path. The relative difference between the adiabatic and isothermal Hall coefficients has been evaluated (1) for a degenerate semiconductor, using Fermi-Dirac statistics and a mean free path, l_I , proportional to the square of the electron energy and associated with electron energy and associated with electron scattering by impurity ions; (2) for a classical impurity semiconductor using Maxwell-Boltzmann statistics and a combined mean free path given by $1/l = 1/l_I + 1/l_L$, where l_L is associated with lattice scattering and is independent of the energy; and (3) for a classical semiconductor at high temperatures such that both electrons and holes take part in conduction and lattice scattering is dominant. In all cases considered the relative difference between the isothermal and adiabatic Hall coefficients has been shown to be negligible when constants typical of germanium, silicon, or tellurium are used in the evaluation. (TID-LC)

595

NEUTRALIZATION OF POTASSIUM AND SODIUM IONS ON TUNGSTEN AND TANTALUM. L. N. Dobrechov, V. N. Lepeshinskaya, and I. E. Bronshteyn. *Zhur. Tekh. Fiz.* 22, 961-7(1952) June. (In Russian)

Investigations are reported on the mechanism of neutralization of K^+ and Na^+ beams on Ta and W surfaces at temperatures up to 2000°C. (G.Y.)

596

THE SOLIDIFICATION CURVE OF HELIUM. II. B. M. Cwiling. *Phys. Rev.* 88, 135-7(1952) Oct. 1.

Apparatus was designed for retracing the solidification curve of He II, with emphasis on eliminating the "He II wire" heat leakage. The melting-pressure curve obtained from three series of measurements is compared with the Swenson curve (*Phys. Rev.* 79, 626(1950)). While the "He II wire" leakage was eliminated, another type of heat leak was intro-

duced, namely, heat leakage from the value of the apparatus. It seems improbable that a really tight valve for He II can be made. Thus it appears that all curves obtained for He II under pressure are considerably stretched along the temperature axis toward 0°K. (L.M.T.)

597

HEAT PULSES IN HE II BELOW 1°K. C. J. Gorter. *Phys. Rev.* 88, 681(1952) Nov. 1.

It has been observed that the width of heat pulses increases greatly in He II below 1°K. This might suggest that at the lowest temperatures one does not have to do with second sound proper but with the normal transmission of heat pulses in a medium of a certain specific heat and thermal conductivity. The formulas of Kronig and Thellung (*Physica* 16, 678 (1950)) might be appropriate to describe the transition to the phenomenon of second sound above 1°K. (auth)

COSMIC RADIATION

598

Palmer Physical Lab., Princeton Univ.
REMARKS ON THE COSMIC-RAY ALBEDO; TECHNICAL REPORT NO. 11, by S. B. Treiman. Nov. 5, 1952. 9p. (AECU-2311; Technical Report No. 11)

Cosmic-ray albedo particles emerging from the atmosphere may be trapped in bound orbits and return to earth as "primary" radiation. The distribution of these albedo primaries as a function of latitude and direction of arrival is calculated, although only order-of-magnitude accuracy is possible, and a lower limit for the number of albedo particles that return to earth is estimated. As many as 40% of the primaries arriving at the equator may be albedo primaries. (G.Y.)

599

Brookhaven National Lab.
ON THE SECONDARIES OF PENETRATING SHOWERS, by C. C. Damm. Aug. 15, 1952. 21p. (BNL-1280)

The momentum spectrum of penetrating-shower secondaries at 11,200 feet altitude has been measured by means of the distribution in projected angle of the multiple coulomb scattering of those particles in a lead plate of a cloud chamber. The resulting spectrum is compared to that obtained for the meson secondaries of stars in photographic plates exposed at 70,000 feet. For mesons above 500 Mev, the two spectra coincide within the errors. At lower energies, and especially around 100 Mev, a marked difference exists. The respective average energies are also different by a factor of about two. All of these differences appear to result both from selecting particles emitted in the forward direction, and from higher energies of the particles producing the primary event in the present experiment. A production of photons in carbon by penetrating-shower secondaries has been observed. Interpreted in terms of π^0 production, this indicates an inelastic charge-exchange scattering in the carbon, in support of other experiments. Three decays of neutral V^0 particles observed show that the cross section for V^0 production by the penetrating shower secondaries is most likely an appreciable fraction of the geometrical cross section. One of the decays has a Q value not less than 35 Mev. (auth)

600

ANOMALOUS DISTRIBUTION OF DISINTEGRATION STARS PRODUCED BY COSMIC RADIATION IN PHOTOGRAPHIC EMULSIONS. L. Barbanti Silva, C. Bonacini, G. Depietri, G. Lovera, and E. Perilli Fedelli. *Nuovo cimento* (9) 9, 630-2(1952) July. (In Italian)

The excess of close pairs of stars in nuclear emulsions over that calculated from a Poisson distribution, reported by Li et al. (*Phil. Mag.* 41, 1152(1950)) and questioned by

Davis (*ibid.* 43, 472(1952)) has been investigated statistically in Ilford G5 plates, 200 μ thick, exposed at 3500 m altitude, either bare or under 2 or 13 cm of paraffin. In no case could other than a simple statistical distribution of close pairs of stars be found. (G.Y.)

601

ON THE INTERACTION OF COSMIC RAYS WITH MATTER UNDER 50 METRES WATER EQUIVALENT. E. Amaldi, C. Castagnoli, A. Gigli, and S. Sciuti. *Nuovo cimento* (9) 9, 969-1003(1952) Oct. (In English)

The production of penetrating secondaries by cosmic rays at 50 m w.e. has been investigated by means of a counter hodoscope. The cross section (in Pb) for events which can be interpreted as pairs of associated penetrating particles (app) is not larger than $13 \pm 3 \times 10^{-30}$ cm²/nucleon. Such a value is deduced from measurements of the corresponding differential cross section as a function of the penetration of the secondary particles produced. A value of the same order of magnitude is found for the production of app in rock. Furthermore it is shown that the events that can be interpreted as showers penetrating 15 cm Pb have a frequency that can be explained, at least in part, as due to purely electromagnetic interaction. Therefore an upper limit of a few units in 10^{-30} cm²/nucleon can be established for the cross section for production in Pb of penetrating showers by μ mesons. Finally those events are discussed which appear to be due to a few penetrating particles coming from the rock, and it is shown that they can be accounted for by considering, besides the production of penetrating showers in rock, the penetrating particles present in the vicinity of the core of extensive air showers. (auth)

602

A CLOUD CHAMBER ANALYSIS OF COSMIC RAYS AT 3500 METRES. PART A. THE ELECTRONIC COMPONENT FROM NUCLEAR DISINTEGRATIONS IN LEAD. A. Lovati, A. Mura, G. Tagliaferri, and S. Terrani. *Nuovo cimento* (9) 9, 946-58(1952) Oct. (In English)

A multiplate cloud chamber has been operated at mountain altitude, yielding 16,000 photographs of random expansions. This paper is intended to study the production of electronic component in nuclear disintegrations induced in Pb by cosmic-ray particles of moderately high energy. Assuming the neutral meson hypothesis, the ratio of the numbers of neutral to charged π mesons forming in these disintegrations is derived to be $0.42 \pm 40\%$. The probability of production of electron-photon component in nucleon-Pb nucleus collisions is suggestively reported for two energy intervals; the indicative values are about 0.3 and 0.6 times the geometrical cross section for incident particle energies centered, respectively, around 2 and 6 bev. It is remarked that the results obtained, though rather poor statistically, are believed to be unaffected by instrumental selections. (auth)

603

EXPOSURE HAZARDS FROM COSMIC RADIATION BEYOND THE STRATOSPHERE AND IN FREE SPACE. Hermann J. Schaefer. *J. Aviation Med.* 25, 334-44 and 401(1952) Aug.

Factors affecting the ionization dosage from cosmic radiation which may be encountered in high altitude aviation are discussed. Theoretically derived determinations of dosages in the outer regions beyond the stratosphere and in free space are presented. (C.R.)

604

STUDY OF THE SOFT COMPONENT OF THE COSMIC RADIATION ON THE PIC DU MIDI. G. Baroni, G. Cortini, A. Milone, L. Scarsi, and G. Vanderhaeghe. *Nuovo cimento* (9) 9, 867-85(1952) Oct. (In French)

The soft component was studied at 43° N, 2860 m altitude

by means of photographic plates sensitive to the minimum of ionization, a systematic examination of individual and electron-pair tracks being made. The differential energy spectra of photons and electrons were established by measurement of the scattering and were normalized according to the measured integral intensities. These spectra are compared with those calculated by Richards and Nordheim (Phys. Rev. 74, 1106(1948)) according to cascade theory. The accord is satisfactory both for the shapes of the spectra and the intensity ratios. The angular distributions found for the soft component (photons and electrons) and for the hard component (mesons) almost coincide and can be represented in the first approximation by a law of the form $I(\theta) d\Omega = I_0 \cos^{3.5} \theta d\Omega$. (tr-auth)

505

MESON PRODUCTION WITH LATITUDE CUT-OFF. Ch. Terreaux. *Nuovo cimento* (9) 9, 1029-31(1952) Oct. (In English)

Cortini et al. (NSA 6-5804) measured the frequency of penetrating showers produced by the primary cosmic radiation with the latitude cut-off at Milan (~3 bev) and concluded that the results did not agree with the plural theory of meson production. The present author contends that the discrepancy was caused by use of calculations valid only for a pure power-law spectrum without cut-off at low energies as it exists at mountain heights. He has extended the calculations of the frequency of penetrating showers when the incident spectrum follows a power law with a latitude cut-off and finds no argument against a predominantly plural meson production. (G.Y.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

506

Brookhaven National Lab.

COMBINED PAIRS OF VACANCIES IN COPPER, by J. H. Bartlett and G. J. Dienes. [nd] 15p. (BNL-1287)

An approximate theoretical calculation is given of the energy of dissociation of vacancy pairs in copper and of the activation energy required for the motion of associated pairs. If two atoms have been removed from neighboring lattice sites, the resulting double vacancy may be more stable than the configuration consisting of two single vacancies far apart. On the assumption that the lattice energy may be regarded as composed of contributions from pairs of atoms, the energy of dissociation of a double vacancy in copper has been estimated as about 0.6 ev. Furthermore, if the interatomic potential energy be represented by a Morse function, the activation energy for the motion of a double vacancy through any f.c.c. metal crystal is about one-half that for a single vacancy. Double vacancies are, therefore, expected to be stable and highly mobile in such metals. (auth)

ELECTRICAL DISCHARGE

607

Atomic Energy Research Establishment, Harwell, Berks (England)

A PHENOMENOLOGICAL THEORY OF THE CONSTRICTED GAS DISCHARGE AT MODERATE CURRENTS, by W. B. Thompson. May 1952. 21p. (AERE T/R 997)

Certain basic parameters necessary for a complete description of the properties of a constricted gas discharge were calculated, following to some extent the formulation proposed by Langmuir and Tonks (Phys. Rev. 34, 876(1929)) in their theory of the low-current discharge. Parameters calculated include electron temperature, wall potential, ion mobility, and power balance. Characteristics of the discharge can be completely described when the gas pressure,

temperature, tube radius, and current are given. The calculations are long but involve the solution of only a single transcendental equation. (L.T.W.)

505

OSCILLATIONS OF PLASMA AND STRIAE. G. V. Gordeev. *Zhur. Eksp'tl'. i Teoret. Fiz.* 22, 230-40(1952) Feb. (In Russian)

The theory of striae, considered as a group of waves, is presented and compared with experimental findings. (tr-auth)

509

DEIONIZATION AND IGNITION POTENTIAL OF RAREFIED GASES IN PRESENCE OF RESIDUAL IONIZATION. S. I. Ardonova. *Zhur. Tekh. Fiz.* 22, 981-8(1952) June. (In Russian)

The process of deionization in post-discharge A, Kr, Ne, and Hg vapor at pressures from 0.1 to several microns of Hg and the relation of ignition potential to residual ionization in these gases have been investigated. (G.Y.)

ELECTRONS

610

ON THE ZITTERBEWEGUNG OF THE DIRAC ELECTRON. Kerson Huang. *Am. J. Phys.* 20, 479-84(1952) Nov.

The detailed motion of a free Dirac electron is investigated by examining the expectation values of the position \vec{r} and of $\vec{r} \times \vec{r}$ in a wave packet. It is shown that the well-known zitterbewegung may be looked upon as a circular motion about the direction of the electron spin, with a radius equal to the Compton wavelength (divided by 2π) of the electron. It is further shown that the intrinsic spin of the electron may be looked upon as the "orbital angular momentum" of this motion. The current produced by the zitterbewegung is seen to give rise to the intrinsic magnetic moment of the electron. (auth)

611

QUANTUM EFFECTS IN THE RADIATION FROM ACCELERATED RELATIVISTIC ELECTRONS. L. I. Schiff. *Am. J. Phys.* 20, 474-8(1952) Nov.

The radiation associated with the operation of a betatron or synchrotron, due to the transverse acceleration of relativistic electrons by the magnetic field of the machine, is discussed qualitatively. Order-of-magnitude expressions for the angular opening of the cone within which the radiation is emitted, and for the wavelength of the maximum of the radiated spectrum, are obtained by means of qualitative arguments based on classical physics. It is then shown, from a consideration of the rate of spread of a wave packet that describes the electron, that quantum effects are negligible so long as the ratio γ of the total energy to the rest energy of the electron is small in comparison with the square root of the ratio of the orbit radius R to the reduced Compton wavelength λ_c of the electron. This criterion for the validity of classical theory is substantially equivalent to, but not identical with, the commonly accepted criterion $\gamma^2 \ll R/\lambda_c$, in comparison with the momentum of the electron. Thus classical theory is expected to be valid for electron energies small in comparison with 10^{15} ev if the magnetic field strength does not exceed 10^4 oersted. (auth)

GASES

612

Knolls Atomic Power Lab.

CONSTANTS IN THE EQUATION OF STATE OF A GAS, by Leo F. Epstein. [nd] 6p. (AECU-2322)

Relations between the coefficients of the virial equation of state of a gas and those of the equation of state in which the volume is explicitly expressed in terms of the pressure are

often derived by assuming the ideal gas value $V = RT/p$ to be a sufficiently accurate approximation of the virial equation. This procedure may lead to large errors, in sign and magnitude, of the coefficients. An exact general method is presented for going from the virial equation to the volume-pressure equation. An exact expression for the relation between the coefficients is readily obtained. (L.T.W.)

611

SECONDARY PROCESSES ACTIVE IN THE ELECTRICAL BREAKDOWN OF GASES. Leonard B. Loeb. *Brit. J. Applied Phys.* 3, 341-9(1952) Nov.

Recent advances in techniques and consequent results indicate the complexity of gaseous breakdown mechanisms. The three cathode mechanisms and two anode mechanisms are carefully analysed indicating their relative importance and conditions of appearance. They are shown to lead to the same type of generalized breakdown threshold condition with statistical fluctuations and subject to alteration by space charges. This condition masks the processes active rendering analysis difficult. The threshold mechanisms alone do not determine the breakdown for this involves the ultimate resulting discharge. The factors modifying the discharge are gas type and state, electrodes, geometrical factors, and external circuit constants. The discharge types to which these lead and governing circumstances are presented. In conclusion, proper modern methods of discharge analysis are indicated. (auth)

INSTRUMENTS

614

Knolls Atomic Power Lab.
APPLICATION OF PULSE COUNTING METHODS TO MASS SPECTROMETRY, by F. A. White and T. L. Collins. [nd] 3p. (AECU-2288)

The pulse-counting technique for measuring very small positive ion currents in a mass spectrometer is especially suited to cases where an electron multiplier is used as a detector. Each positive ion which produces one or more electrons at the first dynode of the electron multiplier creates a single pulse at the output. The smallest detectable current is limited by the rate at which thermionic electrons are emitted from the first few dynodes, while the largest current is determined by the speed of the pre-amplifiers and scalars employed. For currents greater than 10^{-14} ampere, a vibrating reed has been used in place of the pre-amplifiers and scalars. The background current of the system is about 5×10^{-20} amp. (L.M.T.)

615

Northwestern Univ.
NOMOGRAMS USED IN ANALYSIS OF DATA IN THE REACTION $\text{Li}^6(n, \alpha)\text{H}^3$, by Mary L. Boas. [nd] 10p. (AECU-2298)

Several nomograms and similar computational devices have been found useful in the analysis and interpretation of data from the reaction $\text{Li}^6(n, \alpha)\text{H}^3$ in photographic emulsions. Three of these are discussed here: (1) a slide rule to determine, from measurements on a track with the triton in a small forward cone, what the track length would have been if the triton had gone exactly forward; (2) a nomogram to determine the true alpha-triton angle from its measured projection in the plane of the emulsion; (3) a device for determining, from measurements on a track, the angle between the emulsion and the incident neutron giving rise to the track. (auth)

616

Argonne National Lab.
A MANUAL OF REMOTE VIEWING. Aug. 11, 1952. 44p. (ANL-4903)

The basic requirements and techniques of viewing systems

are discussed briefly. Description, application, performance, materials, and design and construction details are discussed for shielding windows. The applications, design, and performance of various types of periscopes are described. Simple reflecting systems, submerged operation, and television are briefly treated. (L.M.T.)

617

Los Alamos Scientific Lab.
A FOUR-ADDRESS, EIGHT-DIGIT FLOATING DECIMAL CODING SYSTEM FOR THE C.P.C. MODEL II (NO. 1 BOARDS), by Dura W. Sweeney. Sept. 1952. 46p. (LA-1475)

This paper introduces the latest set of control panels designed for the Card Program Computer (C.P.C.). The panels are wired for general-purpose use for all problems which can be reduced to a chain of arithmetic operations. Since the C.P.C. operates normally at the rate of 150 cards per minute with a fixed amount of calculate-time between cards, the problem has been to design control panels which make maximum use of this calculate-time and still retain a simple and flexible coding system. The design of this set of control panels contains both single and double operations (three and four address codes). Channel X has been extended to permit addresses to all eight counter-groups, and an improved set of transcendental functions is available. The coder will still have the advantages of automatic resetting of the counter-groups, the availability of four possible instruction fields, SRI and SRO, and other operations present in older designs. This paper is organized so that an experienced coder can get a complete summary of all possible operations and controls, as well as the printing and card layout in the last six pages. All items in the summary as well as other aids to coders are fully explained in the main text. (auth)

618

Radiation Physics Lab., National Bureau of Standards
REPORT ON SOME CHARACTERISTICS OF THE IET DECIMAL COUNTING TUBE, by Edward R. Saunders. Oct. 10, 1952. 7p. (NBS-1990)

Tests were carried out with four IET decimal counting tubes in order to determine some of their operating characteristics. Minimum acceptable pulse heights varied from 15 to 19 volts and maximum acceptable pulse heights from 33 to 35 volts. The minimum pulse width required to trigger the tubes was 4 to 6 μsec . Circuit and block diagrams of the testing equipment are included. (L.M.T.)

619

New York Operations Office, AEC
OPERATING INSTRUCTIONS FOR AIRBORNE TAPE RECORDER AND PLAYBACK UNIT NYO TYPE TK-3. Oct. 22, 1952. 3p. (NYO-4502)

The airborne tape recorder and playback unit NYO Type TK-3 is self-contained and consists of a two-channel tape recorder and associated circuitry which record continuously a d-c input signal with simultaneous additional explanatory information. When used with a Scintilog NYO Type TH-2, the unit is suitable for airborne monitoring of ground γ -ray levels. Operating instructions for the instrument are given. (L.T.W.)

620

Radiation Lab., Univ. of Calif., Berkeley
DESIGN OF RADIATION HEATED CATHODES FOR ION PUMPS, by W. E. Bush. Oct. 9, 1952. 24p. (UCRL-1929)

The systematic development of radiation-heated cathodes for ion pumps is presented. The cathode described consists of a tantalum or tungsten disk, which acts as an emitter, heated by a suitable filament contained in a heat-shielding can of appropriate design. (auth)

ISOTOPES

621

Oak Ridge National Lab.

ELECTROMAGNETICALLY ENRICHED ISOTOPES. INVENTORY, OCTOBER 31, 1952, by C. P. Keim, C. E. Normand, and Boyd Weaver. Oct. 31, 1952. 39p. (ORNL-1428)

This inventory lists the isotopes which have been concentrated electromagnetically, along with the completed information on their enriched abundances, and the element weights and product forms available in milligram quantities to users on Atomic Energy Commission projects and in university and industrial laboratories. (auth)

622

ON THE NON-EXISTENCE OF A LONG-LIVED ISOMER OF Ti^{51} . Wilhelm Forsling and Amal Ghosh. *Arkiv Fysik* 4, 331-6(1952). (In English)

Ti from a pile-irradiated sample was separated in the isotope separator. No activity from Ti^{51} was detected. Radiochemical separation also proved that the activity of the sample did not belong to Ti but to Ta occurring as impurity. β spectra of the original sample and that of the chemically separated Ta showed close similarity to each other and to the spectrum of Ta^{182} reported by others. (auth)

ISOTOPE SEPARATION

623

ANG. EN NY METOD FOR ISOTOPSEPARERING. [NOTES ON A NEW METHOD OF ISOTOPE SEPARATION], by Nore Bergner. June 7, 1948. 71p. (NP-4203)

The small separation constants usually obtained in centrifugal isotopic separation can be augmented considerably by making use of the properties of the potential vortex. The separation factor is the same as the partial pressure ratio between the isotopes, measured at two different distances from the center, and the gas pressure can be increased to very high values in such a vortex. A stable sedimentation equilibrium can be obtained at an arbitrarily selectable radius. The molecular weight of the gas must be low in order for the pressure drop to be reasonable but heavy enough that a sedimentation equilibrium may exist. The radial velocity of the gas should be large enough so that a vortex motion is maintained. A study of the hydrodynamic conditions for cyclone motion is reported. A general derivation of formulas required for calculation of vortex separation is made. A sample calculation is carried out for UF_6 separation. (L.T.W.)

624

THE CHEMICAL ISOTOPE SEPARATION PROCESS AS A RECTIFICATION PROBLEM. E. W. Becker and K. Bier. *Z. Naturforsch.* a7, 651-64(1952) Oct. (In German)

A method for determining the optimal operating conditions for single columns and column cascades is developed, the enrichment of C^{13} by the $HC^{13}N(g) + NaC^{12}N(aq) \rightleftharpoons HC^{12}N(g) + NaC^{13}N(aq)$ reaction being taken as an example. The dependence of separation properties of packed columns on the parameters of interest was determined experimentally in 60 separate studies. The sharpness of separation could be improved significantly by a special activation process. A four-stage separation cascade for a plant producing 0.18 mole/day of C containing 12% C^{13} is designed on the basis of the experimentally obtained data and the derived equations. (tr.-auth)

625

EXPERIENCE WITH A CHEMICAL EXCHANGE INSTALLATION FOR ENRICHMENT OF C^{13} . E. W. Becker, K. Bier, S. Scholz, and W. Vogell. *Z. Naturforsch.* a7, 664-8(1952) Oct. (In German)

The practical construction of the four-stage separation cascade designed in the preceding work (cf. preceding abstract) is described. The plant yields 0.18 mole/day of the specified C containing 12% C^{13} , while the design called for 0.18 mole/day. The production concentration of 12% C^{13} is attained after a run time of ~53 hr. (tr.-auth)

MASS SPECTROGRAPHY

626

Oak Ridge National Lab.

MASS SPECTROMETER STUDIES OF HIGH VACUUM MATERIALS, by John R. Sites and Russell Baldock. Oct. 10, 1952. 10p. (ORNL-1405)

Observations were made of the most abundant ions in a mass spectrometer upon heating materials commonly used in high-vacuum work. Materials investigated were Teflon, silicone rubber, and Octoil-S diffusion pump oil. (auth)

627

TABLE FOR CALCULATION OF N^{15} CONCENTRATION BY MASS SPECTROMETRIC ISOTOPE ANALYSIS. Lynn D. Abbott, Jr. and Mary J. Dodson. *Anal. Chem.* 24, 1860 (1952) Nov.

A table of use in calculations involved in analysis of N_2 samples for N^{15} concentration by the isotope-ratio mass spectrometer is presented. The table gives the ratio of I^{29}/I^{28} to at. % N^{15} , where I^{29} = ion current of mass 29 and I^{28} = ion current of mass 28. (L.T.W.)

MATHEMATICS

628

Argonne National Lab.

THE DESIGN AND CONSTRUCTION OF THE OAK RIDGE COMPUTER AT ARGONNE NATIONAL LABORATORY, by J. C. Chu. Sept. 3, 1952. 19p. (AECU-2309; UAC-660)

The ORACLE (Oak Ridge Automatic Computer Logical Engine) is a general purpose digital computer. In logical design, it belongs to the parallel asynchronous type. The number system is binary with fixed binary point. The orders which can be executed by the machine can be classified as of the following types: arithmetic, memory and arithmetic unit transfer, control transfer, memory and auxiliary memory transfer. A total of 77 individual orders is provided. (G.Y.)

629

Argonne National Lab.

A DIRECT METHOD FOR DETERMINING THE TRANSFORMATION MATRIX FOR THE DIRAC EQUATION, by M. K. Brachman and Morton Hamermesh. Feb. 1952. 3p. (AECU-2318; UAC-656)

In the theory of the Dirac equation, the effect of a space-time transformation is the replacement of the 4-component wave function ψ by $S\psi$, where S is the transformation matrix. Relativistic invariance requires that $S^{-1}\gamma^\mu S = a_{\mu\nu}\gamma^\nu$, where γ^ν are the Dirac matrices and $a_{\mu\nu}$ is the matrix of the space-time transformation. The calculation of S for given $a_{\mu\nu}$ is usually not done; either one verifies that some S satisfies this equation or one uses properties of continuous groups. The purpose of this note is to give a direct method for solving this equation for the basic space-time transformations. (auth)

630

Oak Ridge National Lab.

CRITICAL VALUES OF THE LOG-NORMAL DISTRIBUTION by Jack Moshman. Issued Dec. 2, 1952. 30p. (ORNL-1427)

A common statistical problem is that of testing a null hypothesis using a statistic drawn from some unknown distribution. The general configuration of the probability density function is known from empirical evidence. It is

suggested that for certain applications, the logarithmic-normal distribution be used to approximate the unknown distribution by equating the first three moments. It would then be convenient to have a table of critical values of the log-normal distribution, standardized for the first two moments and tabulated for various values of the skewness. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

631

[Los Alamos Scientific Lab.]

MEASUREMENT OF NEUTRON SPECTRA USING NUCLEAR EMULSION TECHNIQUES, by Louis Rosen. [nd] 25p. (AECU-2285; LADC-1209)

A summary is given of the techniques and difficulties of measuring neutron spectra by means of nuclear emulsions, for both extended anisotropic sources and point sources. Experiments were carried out involving measurement of the spectra of neutrons emitted by Al, Ag, and Bi when bombarded by 14-Mev neutrons, these being produced by the impingement of 200-kev deuterons upon a ZrT target. The neutron source was surrounded by a spherical shell of the material under investigation and the spectrum of the emergent neutrons measured by proton recoils in nuclear emulsions. It was shown that (1) the energy distribution was maxwellian with maximum intensity at ~ 1 Mev; (2) the level density vs. at. wt. was more or less flat above 50, assuming only n-n processes; and (3) these spectra were essentially the same as that from proton-induced interactions for comparable excitation energies and angular momenta. (L.M.T.)

632

Argonne National Lab.

AN AUTOMATIC X-RAY REFLECTION SPECIMEN HOLDER FOR THE QUANTITATIVE DETERMINATION OF PREFERRED ORIENTATION, by Warren P. Chernock, Sylvania Electric Products, Inc. and Melvin H. Mueller and Howard R. Fish, Argonne National Lab. and Paul A. Beck, Univ. of Illinois. Oct. 1952. 11p. (AECU-2300; UAC-657)

The reflection specimen holder was developed, which has several new features. A removable jig, which fits into the inner ring, is used for the rapid alignment of the specimen. Two different specimen scanning devices are described, which allow the primary beam to cover successively a large number of grains in the specimen surface while the diffracted intensity is being measured. Since many such time consuming measurements are required for an accurate pole figure, the operation of the instrument and the recording of the data have been made automatic. (auth)

633

Argonne National Lab.

DEVELOPMENT OF A DILATOMETER FOR TEMPERATURES 1000° TO 2500°C, by George B. Eyerly and Wingate A. Lambertson. Nov. 1952. 3p. (AECU-2308; UAC-666)

A high temperature dilatometer has been designed to measure the thermal expansion of materials in a vacuum between 1000 and 2500°C. These limits may be expanded if necessary. This precision equipment in conjunction with the high-temperature x-ray camera should extend the knowledge of the thermal expansion properties of refractory materials by 1000°C. (auth)

634

Northwestern Univ.

MEASUREMENT OF THE ENERGY OF ISOTROPIC FAST NEUTRONS WITH Li^6 LOADED EMULSIONS, by J. H. Roberts, W. O. Solano, D. E. Wood, and H. B. Billington. [nd] 15p. (AECU-2320)

E1 and C2 Ilford plates (100 μ) loaded with enriched Li^6 were exposed to neutrons from $\text{Li}^7(p,n)\text{Be}^7$ and $\text{H}^3(p,n)\text{He}^3$. The plates were rotated to mock-up isotropic incidence.

Neutron energies ranged from 200 to 1500 kev. The plates were faded and developed so as to obtain good triton-alpha discrimination. Peaks having widths from 100 to 300 kev at half maximum were obtained, depending upon neutron energy and selection criteria. (auth)

635

Argonne National Lab.

INSTRUMENT RESEARCH AND DEVELOPMENT DIVISION QUARTERLY REPORT FOR JUNE, JULY, AND AUGUST 1952, by F. R. Shonka. Sept. 1952. 26p. (ANL-4885)

The pulsed x-ray method (AECU-2243) is given for determining the decay of luminescence of organic phosphors. Preliminary electron drift-velocity measurements have been made by observing the transient current resulting from a pulse of photoelectrons from the cathode of a parallel-plate chamber. The efficiency of polystyrene-terphenyl phosphors has been increased by use of freshly distilled styrene monomer, elimination of the use of benzoyl peroxide to initiate polymerization, and exhausting of air from the styrene-fluor solutions before sealing off in glass polymerization vials. An instrument has been developed for the measurement of resistance of 10^8 to 3×10^{13} ohms with an accuracy of 1.0% under potential drops of 0.1 to 10.0 v. A detailed description of the instrument and a circuit diagram is given. (L.M.T.)

636

National Bureau of Standards

BIBLIOGRAPHY ON GEIGER-MUELLER PHOTON COUNTERS, by Edward J. Walker. Feb. 1, 1952. 16p. (NBS-1050)

This bibliography includes references to most of the articles on G-M photon counters which have appeared in English and German and to a selection of articles in French, Russian, and Italian. Where possible, the author's abstract and comments by the compiler of this bibliography on each article are included. There are a total of 81 references. (L.T.W.)

637

New York Univ.

PROGRESS REPORT NO. 5 FOR MONTHS INCLUDING FEBRUARY, MARCH AND APRIL, 1952 ON FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. July, 1952. 92p. (NP-4086; Progress Report No. 5)

A review on the status of high energy radiation measurements with the aid of luminous material and the results gathered on energy storage and stimulation in Ag activated NaCl crystals are presented. Results of measurements on the decrease in stimulated intensity for various luminescent powders as a function of the time lapse between excitation and stimulation are reported. (J.E.D.)

638

Naval Research Lab., Metallurgy Div.

DOSIMETRY OF IONIZING RADIATIONS BY MEANS OF COLOR CENTERS IN SENSITIZED ALKALINE-EARTH SALTS, by James H. Schulman, Robert J. Ginther, and Russell D. Kirk. Oct. 13, 1952. 18p. (NRL-4062)

The relationship of lattice defects—particularly vacancies and impurity ions—to the x-ray-induced discoloration of alkali-halide crystals is briefly reviewed. These concepts are then extended to alkaline-earth salts, leading to the prediction that such salts should be more easily discolored by ionizing radiations if they are "sensitized" by the incorporation of monovalent positive-ion impurities. This prediction is confirmed experimentally by addition of various alkali-impurities to a number of alkaline-earth compounds. The "sensitization" is particularly effective with strontium sulfate. Crude dosimeters made from sensitized strontium sulfate are described. It is found possible to distinguish between doses of 0, 50, 100, 200, and 400 roentgens of radium

gamma rays by simple visual inspection of these dosimeters. (NRL)

639

Massachusetts Inst. of Tech.

PROGRESS REPORT FOR THE PERIOD APRIL 1, 1952 TO AUGUST 31, 1952. PART I. DOSIMETRY RESEARCH, by Bernard E. Proctor and Samuel A. Goldblith. Sept. 1, 1952. 38p. (NYO-3339)

The calibration of a kilocurie Co^{60} γ source by three types of dosimetry is described. It is concluded that for routine use the ferrous-ferric dosimeter is most suitable. It was found to be easy to use and to give accurate, reproducible results. The methylene blue dosimeter gave results consistent with other determinations. It shows promise as a dosimeter, although an increase in precision is desirable. The adiabatic calorimeter is not suitable for routine dose measurements because of the time involved in its use. However, it proved satisfactory in primary determination of dose rate of the Co^{60} source. (C.R.)

640

New York Operations Office, AEC

OPERATING INSTRUCTIONS FOR NYOO SCINTILLOG: TYPE-TH-2-A LOW LEVEL; TYPE-TH-2-B HIGH LEVEL. Oct. 10, 1952. 3p. (NYO-4009)

The NYOO Scintillog is a wide-range γ -ray-detection instrument consisting of a photomultiplier tube with a γ -sensitive crystal arranged in a circuit so that the applied voltage to the multiplier is varied in order to obtain essentially constant anode current. Measurement of the photomultiplier-tube voltage gives a response that is approximately proportional to the logarithm of the γ -ray intensity. Operating instructions for this instrument are given. (L.T.W.)

641

IONIZATION CHAMBER OF LOW CAPACITANCE. G. Bertolini and A. Bisi. *Nuovo cimento* (9) 9, 1022-4(1952) Oct. (In Italian)

A grid ionization chamber of low capacitance has been built which is able to detect particles of 100 kev. The ratio between signal and noise is ~ 5 . (auth)

642

BORON LAYER SCINTILLATION NEUTRON DETECTORS. E. Gatti, E. Germagnoli, A. Persano, and E. Zimmer. *Nuovo cimento* (9) 9, 1012-21(1952) Oct. (In English)

Neutron detection with layers of crystalline powder mixtures of a boron compound and of a scintillator, used in connection with a photomultiplier, has been studied. Efficiency of 6% for incident thermal neutrons and almost complete insensitivity to γ and cosmic rays is obtained. The detector's geometry approaches that of an infinitely thin sheet. Pulses may be shaped so as to have less than half a microsecond rise time. (auth)

643

A DIRECT CURRENT AMPLIFIER RECORDING SYSTEM FOR PRECISE MEASUREMENT OF DEPTH DOSE. H. E. Johns, E. R. Epp, and S. O. Fedoruk. *Am. J. Roentgenol. Radium Therapy Nuclear Med.* 68, 788-96(1952) Nov.

A method for the measurement of depth dose using pen-recording systems has been developed. With this equipment, difficulties arising from the rapid fluctuation of the output from a roentgen-ray machine may be overcome. Depth dose may be measured to an accuracy of 0.5%. The d-c amplifier with its associated probe described in this paper has proved to be a versatile piece of equipment in a radiotherapy department. Various kinds of ionization chambers have been built for use with the amplifier. These include a flat chamber for depth dose measurement, a cylindrical chamber for investigation of isodose distribution, and chambers of larger volume for stray radiation and Ra measurements. The amplifier has

been used in problems other than the measurement of depth dose. These include investigation of isodose distribution, measurement of percentage backscatter, measurement of attenuation of $\text{Co } \gamma$ rays, investigation of radiation distribution on the surface of Cobrest applicators and investigation of radiation distribution from β -ray applicators. (auth)

MESONS

644

THE DISINTEGRATION OF μ MESONS IN CARBON. A. Alberigi Quaranta and E. Pancini. *Nuovo cimento* (9) 9, 959-68(1952) Oct. (In English)

An experiment is described for the study of some of the properties of μ mesons stopped in carbon. The μ^+ and μ^- mesons have been studied separately, and very precise apparent mean lifetimes in carbon of $\tau^+ = 2.22 \pm 0.06 \mu\text{sec}$ and $\tau^- = 2.18 \pm 0.07 \mu\text{sec}$ have been found. The data obtained from these measurements are discussed and compared with those of other experimenters to see if there is a possible difference in the behavior of the positive and the negative mesons. It is concluded that there are no indications for believing that there is a real difference between the natural mean lives of the μ^+ and μ^- mesons, although the eventual possibility of a divergence cannot be excluded. It is further demonstrated that there are no indications for believing the energy spectra of the disintegration electrons to be greatly different for the plus and minus mesons. (auth)

645

PION PRODUCTION AND CHARGE INDEPENDENCE. A. Gamba. *Nuovo cimento* (9) 9, 1032-4(1952) Oct. (In English)

Simple expressions for the relative contributions of all possible isotopic spin states to the cross sections for production of one, two, or three π mesons by $p + p$ or $p + n$ reactions are tabulated. These expressions may be useful in testing the charge-independence hypothesis and in deducing the isotopic spins of composite particles, such as ξ and τ mesons, by comparison with experiment when more powerful particle accelerators are available. (G.Y.)

E46

PRODUCTION OF PHOTOMESONS IN DEUTERIUM. James Keck and Raphael Littauer. *Phys. Rev.* 88, 139-40(1952) Oct. 1.

The reaction $\gamma + d \rightarrow \pi^- + p + p'$ was studied by detecting the meson in coincidence with a recoil proton. Targets of D_2O and H_2O were irradiated by 310-Mev bremsstrahlung. Mesons emitted at $90 \pm 10^\circ$ with an energy of 56 ± 9 Mev were identified by their specific ionization and range in a coincidence-anticoincidence telescope of three scintillators. The recoil protons were counted by a Na(Tl) crystal, and their energy was measured with a pulse-height analyzer. Graphs are given of the angular distribution of the recoil protons integrated over the energy spectrum and of the energy distribution of recoil protons observed at $30 \pm 6^\circ$. The differential cross section computed from the data was $10.8 \pm 1.0 \mu\text{b/sterad}$ for production at 90° by 236-Mev photons. (L.M.T.)

647

NEUTRONS PRODUCED IN THE ABSORPTION OF NEGATIVE π -MESONS AT REST. V. Cocconi Tongiorgi and D. A. Edwards. *Phys. Rev.* 88, 145-6(1952) Oct. 1.

Negative π mesons of energies between 30 and 75 Mev were magnetically selected and passed through three trays of G-M counters before being brought to rest by absorbers of Pb, Sn, Al, and C. Neutrons emitted by the absorbers were thermalized by a large volume of paraffin in which were imbedded 20 BF₃ proportional counters divided into two groups designated as "close" and "far," the counters of each group being connected in parallel. Coincidences of the G-M coun-

ters triggered the sweep of a cathode ray tube, and the amplified pulses of the neutron counters were applied to the tube deflecting plates so that counters "close" and "far" produced pulses of opposite sign. A camera, triggered by the G-M counters, took pictures of the sweep. Data are given on 0.5- to 15.0-Mev neutrons produced in the absorption of π^- mesons at rest by nuclei of Pb, Sn, Al, and C. (L.M.T.)

METEOROLOGY

646

Brookhaven National Lab.

MICROCLIMATOLOGY AT BROOKHAVEN, by Irving A. Singer and Maynard E. Smith. [nd] 23p. (BNL-1279)

Studies of the relation of gustiness classifications employed at Brookhaven National Laboratory to lapse rate and wind speed, seasonal and diurnal variations, radiation and cloud cover, and Sutton's index of turbulence showed that wind gustiness is closely related to the lapse rate of temperature, while the relation to wind speed is not as distinct. Little seasonal variation was found in the frequency of gustiness classes. Most of the gustiness classifications were found to be suitable, but the study indicated the need for some revision in the categories now employed. (C.R.)

640

Brookhaven National Lab.

TEMPERATURE MEASUREMENTS ON A 420-FOOT TOWER, by Daniel A. Mazzarella and Donald K. Kohl. [nd] 24p. (BNL-1284)

Continuous measurements of the ambient air temperature have been made on a 420-ft tower at Brookhaven for nearly 4 yr. Operational requirements associated with reactor operations have established a need for equipment which is durable, stable, and accurate. The sensing elements consist of Leeds and Northrup resistance thermometers (Thermohms), housed in radiation shields and aspirated by a central pump. A 12-point, triple-range recorder effects the successional measurement of temperature at each level. Two Model R Leeds and Northrup instruments record the differences in temperature between the top of the tower and its base, and between the top and an intermediate level. Numerous tests and experiments have been conducted to determine the characteristics of the Thermohms, radiation shields, recorders, and the aspirating system. A technique is described for calibrating the tower thermometers and their associated recorders. Brief mention is made of the importance for lightning protection on a high tower. (auth)

MICROWAVES

650

Naval Research Lab., Electricity Div.

RESONANCE ABSORPTION OF MICROWAVES BY PARAMAGNETIC SUBSTANCES, by Chihiro Kikuchi and Walter W. Wada. Sept. 22, 1952. 69p. (NRL-4015)

This report is an attempt to give a brief yet fairly complete theoretical background for the interpretation of one of the most important phenomena in paramagnetism—namely, resonance absorption of microwaves by paramagnetic salts. The effects of electric fields upon paramagnetic ions arising from certain symmetrical orientations of nonmagnetic atoms surrounding each magnetic ion are matters of prime importance in the theoretical interpretation of this phenomenon. Therefore, simple and yet powerful group theoretical considerations of the crystalline Stark effects are first presented. In the case of cupric salts, for example, quantum mechanical methods are applied to calculate the crystalline Stark levels, the effects of spin-orbit coupling, and the Zeeman effects. These latter effects are primarily responsible for the occurrence of resonance absorption. The nuclear ef-

fects upon the electronic energy levels of the paramagnetic ions give rise to the so-called hyperfine structure in the resonance absorption curve. The quantum mechanical methods for the calculation of these effects are further exemplified in the cases of cupric and manganous salts. Lastly, the contribution to the specific heat of paramagnetic salts arising from the nuclear interactions are calculated. The results of these calculations in the case of hyperfine structure and specific heat for cupric salts are compared with experimental observations and found to be in excellent agreement. (NRL)

NEUTRONS

651

TOTAL CROSS SECTIONS FOR 14-MEV NEUTRONS.

Leonard S. Goodman. Phys. Rev. 88, 686(1952) Nov. 1.

Total cross sections for 14-Mev T(d,n)He neutrons were measured for 21 elements. The deuterium ions were accelerated through a 130-kv potential drop against a tritiated zirconium target. Detection of the neutrons was accomplished with an anthracene crystal and an RCA 5819 photomultiplier tube. The signal, after amplification, was biased so that recoil protons (in the anthracene crystal) of energy less than 12 Mev were not detected. (auth)

NUCLEAR PHYSICS

652

Nuclear Physics Lab., Case Inst. of Tech.

EXCHANGE MOMENTS IN NUCLEI; TECHNICAL REPORT NO. 18, by J. M. Berger and L. L. Foldy. [nd] 37p. (AECU-2303; Technical Report No. 18)

A phenomenological theory of exchange and interaction moments of nuclei is formulated employing the differential charge conservation law as a basis. The most general form for the exchange moment operator is derived on the assumptions (1) that the exchange moment operator can be expressed in terms of dynamical variables describing the nucleons only, (2) that it consists of two-body terms and does not depend on the momenta of the nucleons, (3) that the electric charge in a nucleus is located only at the positions of the protons, and (4) that one can apply the usual symmetry and invariance conditions to the hamiltonian in the presence of exchange moments. The result represents a sum of thirteen terms, the first of which is fixed completely by the nucleon interaction. The isotopic spin, ordinary spin, and angular dependence of the remaining twelve terms are completely determined but each contains an arbitrary function of the internucleonic separation. Taking a gaussian form for these functions, calculations have been made of the exchange contribution to the moments of H^2 , H^3 , He^3 , and of the quenching of nucleon moments in a degenerate Fermi gas as obtains in nuclei. Comparison of the results with experimental data allow one to obtain information as to the relative magnitude of the various terms. The bearing of the results on meson theory is discussed. (auth)

653

Argonne National Lab.

THE ENERGY LEVELS AND THE STRUCTURE OF LIGHT NUCLEI, by D. R. Inglis. Oct. 1952. 131p. (AECU-2314; UAC-651)

This review is especially concerned with applying to light nuclei those nuclear models which have proven successful in explaining many features of heavy nuclei. Special emphasis is placed on the problem of the clustering of nucleons such as alphas within light nuclei and the adaptation of a model or combination of models to explain this phenomenon. 101 references. (L.M.T.)

554

ON A POSSIBILITY OF COVARIANT GENERALIZATION OF THE THEORY OF INTERMEDIATE COUPLING. I. Maurice Jean. *Compt. rend.* 235, 794-6(1952) Oct. 13. (In French)

In order to serve as a base for a covariant generalization of Tomonaga's theory of intermediate coupling, an equation is proposed which gives, following solution by a perturbation method, the well-known results of Feynman's method for a free nucleon. (tr-auth)

655

ON THE DILATATION VIBRATIONS OF THE ATOMIC NUCLEUS. G. Marx. *Naturwissenschaften* 39, 476-7(1952) Nov. (In German)

Although nuclear excitation processes have been treated satisfactorily by the assumption of an incompressible liquid drop model for excitation energies of a few Mev, recent resonance-energy measurements have been extended to >10 Mev. The present note shows that the dilatation vibrations arising as a consequence of the actual compressibility of the nucleus cannot be neglected in this energy region. (G.Y.)

556

NUCLEAR FORCES IN PSEUDOSCALAR MESON THEORY. K. Nakabayashi and I. Sato. *Phys. Rev.* 88, 144-5(1952) Oct. 1.

A perturbational calculation of nuclear potentials has been performed up to the fourth order in coupling constants, assuming pseudoscalar meson theory. In the pseudoscalar theory, the second-order potential is anomalously small, so it is incorrect to discuss the validity of the perturbation theory only by comparing the second order with the fourth order; rather the second plus fourth order should be regarded as the "lowest order." (L.M.T.)

NUCLEAR PROPERTIES

657

Oak Ridge National Lab.
TOTAL NEUTRON CROSS SECTION OF Li^6 , by C. H. Johnson, H. B. Willard, and J. K. Bair. Aug. 26, 1952. *Decl. Oct. 14, 1952.* 13p. (AEC-D-3467; CF-52-8-165)

The total neutron cross section of Li^6 has been measured for neutron energies from 0.035 to 4.2 Mev. A resonance was observed with its maximum at 0.258 Mev which corresponds to 7.47-Mev excitation energy in Li^7 . It is interpreted according to the nuclear dispersion theory as resulting from p-neutrons forming a state of total angular momentum $\frac{5}{2}$. The cross section rises gradually in the region from 1.5 to 4.2 Mev. (auth)

658

Wisconsin Univ.
LEVELS OF Al^{25} FROM THE $\text{Mg}^{24}(\text{d},\text{n})\text{Al}^{25}$ REACTION, by E. Goldberg. [nd] 35p. (AECU-2291)

A 67-kev target of Mg^{24} was bombarded with 4.007-Mev deuterons, and the neutron groups from the $\text{Mg}^{24}(\text{d},\text{n})\text{Al}^{25}$ reaction were studied at seven different angles with Ilford C2 emulsions. The observed Q values are $+0.07 \pm 0.06$, -0.38 ± 0.06 , -0.88 ± 0.05 , -1.74 ± 0.04 , -1.87 ± 0.04 , -2.44 ± 0.04 , -2.67 ± 0.04 , -2.85 ± 0.04 , and -3.04 ± 0.03 Mev. The neutron groups with the Q values -2.44 , -2.67 , and -3.04 Mev correspond to virtual states of Al^{25} which have previously been seen as $\text{Mg}^{24} + \text{p}$ resonances. From the Butler theory for the angular distribution of the stripped neutrons, the ground state of Al^{25} is described by $J = \frac{3}{2}$ or $\frac{5}{2}$, even parity; the first excited state is $J = \frac{1}{2}$, even parity, and the second excited state is likely to be $J = \frac{3}{2}$ or $\frac{5}{2}$, even parity. The level structure of Al^{25} is compared to that of Mg^{25} . (auth)

659

Nuclear Physics Lab., Case Inst. of Tech.
A NEW RIGOROUS LOWER BOUND ON THE RANGE OF THE TRIPLET NEUTRON-PROTON INTERACTION;

TECHNICAL REPORT NO. 19, by Leslie L. Foldy. [nd] 13p. (AECU-2302; Technical Report No. 19)

The experimental values of the electric quadrupole moment and percentage D-state in the deuteron, together with the effective triplet range of the neutron-proton interaction, are employed to determine a rigorous lower bound on the "cut-off" range of the neutron-proton interaction. The latter is defined to be the range beyond which the deuteron wave functions have effectively their asymptotic form. (auth)

660

Palmer Physical Lab., Princeton Univ.
EVIDENCE FOR A NEW LEVEL IN Be^7 , by D. M. Thomson. Oct. 14, 1952. 4p. (NYO-3662)

Recently a new level was found in Li^7 at 4.62 Mev. The corresponding region of excitation in Be^7 had not been previously explored, and it was of interest to discover if there is a mirror level. Protons of 18.3 Mev bombarded Li targets, and neutrons produced by the reaction $\text{Li}^7(\text{p},\text{n})\text{Be}^7$ were detected at 16° and 60° to the incident beam. The spectrum shows evidence for excited states in Be^7 at 4.6 and 7.1 Mev. The 7.1 Mev level can be identified with that found from proton scattering on Li^6 , and the 4.6-Mev level is the mirror of the 4.62-Mev level in Li^7 . The best estimate of the energy of the excited level is 4.6 ± 0.2 Mev. (L.T.W.)

661

ENERGY LEVELS OF HEAVY NUCLEI. F. Ferrari and C. Villi. *Nuovo cimento* (9) 9, 927-39(1952) Oct. (In Italian)

The level density of a standard heavy nucleus is calculated taking into account the modifications brought about by nuclear interactions in the Fermi gas model. Their effect on the energy-temperature dependence is evaluated by the aid of the following relation: $\tau = T + a\psi(\tau)$ between the equivalent temperature τ and the true temperature T . The energy-temperature relation may be derived either on the basis of the exact Fermi expressions for the number of particles and their total energy or by modifying the coefficient b of the law $E = bT^2$, which may be written in the form $E = B(a,T)T^2$. The function $B(a,T)$ depends strongly on the parameter a and is slowly varying with temperature in the energy range $0 \leq E < 10$ Mev. The parameter a is closely related to the thermonuclear energy as expected from Watanabe's ratio $K^{(2)}/K^{(0)} = 0.34$. Its value was found to be 0.35 instead of 0.29 as given by this author; such difference is due to the fact that exact expressions of Fermi statistics have been throughout used instead of the approximated ones in the equivalent temperature region. The energy levels have been calculated with Bethe's formula taking into account modified expressions for the nuclear specific heat and entropy. The mean value of $B(a,T)$ in the considered energy region is fairly well fitted with Bardeen's previsions, although derived on substantially different assumptions. The calculated energy levels are compared with other theoretical predictions and with the experimental values observed for Pd^{103} . The agreement between the present previsions and those obtained with the liquid drop model is briefly discussed. (auth)

562

STRIPPING AND THE NUCLEAR SHELL MODEL. S. T. Butler. *Phys. Rev.* 88, 685(1952) Nov. 1.

It was suggested by Bethe and Butler (*Phys. Rev.* 85, 1045(1952)) and Butler (*Proc. Roy. Soc. A208*, 559(1951)) that the angular distributions of (d,p) and (d,n) should give a sensitive measure of the accuracy of the nuclear shell model and that the angular distributions are characterized by the orbital angular momenta l with which the captured particle can be accepted into the final states. Experiments have since been performed along this line and emphasis is placed here on making clear their interpretation, i.e., what nuclear property determines the relative heights of the maxima resulting from different l values. (L.M.T.)

NUCLEAR REACTORS

663

[Oak Ridge National Lab.]

CHAPTER 3: CRITICALITY PHYSICS OF THE LOW COST REACTOR, by [P. J. Sykes and F. H. Abernethy]. [nd] Decl. Nov. 6, 1952. 25p. (AECD-3464)

Diffusion theory and the two-group model were employed in calculating the critical mass and size of a reactor and the expected spatial distributions of the fast flux and of the thermal flux. Two distinct problems were solved: (1) criticality of a clean, cold, unpoisoned cell assembly in infinite water in the absence of beam holes, experimental absorbers, and external Al structure and (2) criticality of the operating low-cost reactor assuming one Mw power, 10% burnup, fission product poisoning, beam hole losses, and the presence of reasonable absorption losses. (L.T.W.)

664

Knolls Atomic Power Lab.

METALLURGY FOR NUCLEAR REACTORS, by J. E. Burke. Oct. 21, 1952. 17p. (AECU-2321)

Some criteria for selecting materials for reactor application are considered. The components of a reactor are described, and work done at Knolls Atomic Power Laboratory on development of reactor materials, development of processes and techniques, metallurgy of U, and fuel-element metallurgy is reviewed. (L.T.W.)

665

Atomic Energy Research Establishment, Harwell, Berks (England)

MEASUREMENT OF THE NEUTRON SPECTRUM AT THE CENTRE OF THE HARWELL PILE, by B. T. Taylor. Sept. 1, 1952. 20p. (AERE N/R 1005)

The neutron energy spectrum at the center of the Harwell Pile has been measured using a crystal spectrometer. The spectrum can be fitted between 0.02 and 5 ev by the relation

$$\rho(E)dE = \left[E^{\frac{1}{2}} e^{-E/0.028} + 3.2 \times 10^{-6} E^{-\frac{3}{2}} \left[1 - \left(\frac{E}{0.12} \right)^{10} + 1 \right]^{-1} \right] dE$$

corresponding to a neutron temperature of 326°K. The mean graphite temperature near the center of the pile was ~325°K during the period of the experiment. The cadmium ratios of indium, manganese, and vanadium have been measured in the same neutron beam, and agree satisfactorily with values calculated from the derived spectrum and the known absorption cross-sections. The expected higher order contamination is also derived and shows reasonable agreement with measured values between 0.02 and 5 ev. (auth)

666

Atomic Energy Research Establishment, Harwell, Berks (England)

LECTURE NOTES ON PILE THEORY, by C. A. Rennie. 1952. 33p. (AERE R/L 5)

These lecture notes deal with the basic nuclear design features of natural U-graphite-moderated thermal reactors. Where possible references are given to published papers which contain a fuller treatment of the points under discussion. (auth)

667

Atomic Energy Research Establishment, Harwell, Berks (England)

A QUANTITATIVE STUDY OF URANIUM-GRAPHITE LATTICES, by E. A. Guggenheim and M. H. L. Pryce. Issued Aug. 11, 1945. Revised June 1952. 41p. (AERE R/R 922)

The quantity of U required for reactor criticality, the multiplication factor, the square of the neutron migration length, and the laplacian are calculated for various geometries.

The reacting core is a circular cylinder of equal height and diameter completely surrounded by a graphite reflector. The parallel U rods are arranged in a square or regular hexagonal lattice. The radius and pitch of the rods, width of an air gap surrounding each rod, and the thickness of the Al cans are varied. (L.T.W.)

668

Brookhaven National Lab.

NOMOGRAPH FOR THE CRITICAL EQUATION, by F. T. Miles, Brookhaven National Lab. and Harry Soodak, College of the City of New York. [nd] 3p. (BNL-1271)

The solution obtained by successive approximations of of the critical equation, $k e^{\tau \Delta} - 1 + L^2 \Delta = 0$, where k is the multiplication constant for an infinite pile, τ the age, L the diffusion length, and Δ the critical laplacian, is time consuming. From the nomograph of this report, which includes three scales of k and $\tau \Delta$ and one L^2/τ scale, solutions are obtained directly. (L.M.T.)

NUCLEAR TRANSFORMATION

669

Wisconsin Univ.

ELECTROSTATIC ANALYSIS OF NUCLEAR REACTION ENERGIES, III, by D. J. Donahue, K. W. Jones, M. T. McEllistrem, and H. T. Richards. [nd] 12p. (AECU-2296)

Electrostatic analysis of incident and product particles have been used to measure the following reaction energies: $\text{Na}^{23}(p,\alpha)\text{Ne}^{20}$ (2.379 \pm 0.003 Mev); $\text{Na}^{23}(p,\alpha)\text{Ne}^{20*}$ (0.745 \pm 0.002); $\text{Na}^{23}(p,p)\text{Na}^{23*}$ (-0.439 \pm 0.001 Mev); $\text{Mg}^{24}(p,p)\text{Mg}^{24*}$ (-1.371 \pm 0.002 Mev); $\text{Al}^{27}(p,p)\text{Al}^{27*}$ (-0.843 \pm 0.002 Mev); $\text{Al}^{27}(p,\alpha)\text{Mg}^{24}$ (1.594 \pm 0.002 Mev); and $\text{Al}^{27}(p,\alpha)\text{Mg}^{24*}$ (0.228 \pm 0.003 Mev). (auth)

670

Argonne National Lab.

FISSION YIELDS IN URANIUM-235 AND URANIUM-238, by Donald Engelkemeir, M. S. Freedman, E. P. Steinberg, J. A. Seiler, and L. Winsberg. Nov. 1952. 87p. (ANL-4927)

The primary aim of this study was to put fission yields from U^{235} on a quantitative basis. The absolute fission yield of a convenient reference nuclide, Ba^{140} , was measured in a more direct manner than had previously been done. Fission yields in U^{235} and in U^{238} were compared for a number of nuclides to determine whether the fission yields in natural U in a thermal-neutron reactor might be influenced appreciably by fast fission of U^{238} . As a result of this last experiment it was noted that the fission yield curves in U^{235} and U^{238} have significantly different shapes. (auth)

671

Brookhaven National Lab.

PRODUCTION OF Fe^{59} BY THE $\text{Co}^{59}(n,p)$ REACTION IN THE BROOKHAVEN REACTOR, by Arthur C. Wahl. [nd] 3p. (BNL-1274)

Two 1-g samples of Co_2O_3 (<0.002% Fe), one of which was wrapped in 45 mils of Cd, were irradiated for 1 hr in the Brookhaven reactor at an estimated flux of 3×10^{12} neutrons/cm²/sec. After chemical purification and extraction procedures, aliquots of the samples were mounted on glass cover slips and counted in a Nucleometer internal proportional counter attached to a scaler. The yields with or without Cd were the same within the limits of experimental error, 0.040 and 0.036 μc , indicating little or no Fe^{59} was produced by slow neutron capture in Fe impurities. (L.M.T.)

672

Columbia Univ.

NEUTRON CAPTURE CROSS-SECTIONS FROM (n,γ) REACTIONS (abstract), by E. B. Meservey, W. W. Havens, and L. J. Rainwater. [nd] 1p. (CU-99; CR-1710)

Measurements of neutron capture cross-sections have been made by detection of capture gammas emitted from a sample placed in the slow-neutron beam of a neutron velocity selector. Counting rates in scintillation counters near the sample have been plotted against neutron time-of-flight to give a measure of relative (n,γ) cross-sections as a function of neutron energy. Orientation studies on indium and silver showed the well-known resonances in these substances; the silver measurements were carried into the thermal region and showed the characteristic $1/v$ slope. Preliminary measurements have been made in the resonance region on samples of Cd, BaO, and SrF_2 . Resonances have been detected in Cd at about 27 and 90 ev, (This resonance may be the same as that reported previously at 110 ev, Coster, Groendijk, and DeVries, *Physica* 14,1.) in Ba at about 25 and 101 ev, and in Sr at 3.5 ev. Comparative studies on Cd and Ag in the thermal region roughly confirm measurements by Muehlhause (*Phys. Rev.* 79, 277(1950)) of the relative capture-gamma multiplicity of these two substances. (Entire Report, Abstract of paper for N. Y. Meeting of the Am. Physical Society, Jan. 31, 1952.)

673

STRIPPING AND PICK-UP DIFFERENTIAL CROSS SECTIONS. S. T. Butler and E. E. Salpeter. *Phys. Rev.* 88, 133-4(1952) Oct. 1.

The differential cross sections expected from (d,t) and (t,d) reactions as a result of stripping and pickup were calculated. The method is identical with that employed for (d,p) and (p,d) reactions (Butler, *Proc. Roy. Soc. (London)* A208, 559(1951)), Coulomb effects again being neglected. The form factor ϕT^2 is determined to be the momentum distribution (of the third particle) in a triton when it has a configuration of a deuteron ground state plus third particle. The dependence of the (d,t) and (t,d) angular distributions on the form factor ϕT^2 is shown for the reaction $\text{C}^{13}(d,t)\text{C}^{12}$ with 8-Mev deuterons. (L.M.T.)

674

A FURTHER TEST OF THE SHELL MODEL. J. S. King and W. C. Parkinson. *Phys. Rev.* 88, 141-2(1952) Oct. 1.

The angular distribution of the protons associated with the ground state in the reaction $\text{Cl}^{35}(d,p)\text{Cl}^{36}$ was measured as a test of the accuracy of the shell model in ascribing definite orbital angular momentum states to nucleons in a nucleus. The results of the measurement indicate that the neutron carries mainly two units of orbital angular momentum into the residual nucleus and is presumably a $d_{3/2}$ nucleon as required by the shell model. Assuming that the ground state is a single level (there is some evidence of a doublet structure as in the case of P^{32}), the amount of admixture of $l_n = 0$ appears to be less than 4%. It is difficult to set a limit on the $l_n = 4$ admixture, particularly because of the uncertainty in the "background." (L.M.T.)

675

HIGH ENERGY NUCLEAR REACTIONS AND THE GOLDBERGER MODEL. J. W. Meadows. *Phys. Rev.* 88, 143-4 (1952) Oct. 1.

The Goldberger model (*Phys. Rev.* 74, 1269(1948)) considers high-energy nuclear reactions as occurring in two steps: (1) a high-energy particle knocks out one or more nucleons, leaving the residual nucleus in an excited state, and (2) this excited nucleus may evaporate other nucleons or emit photons according to the statistical theory. The probabilities of the various knock-out processes were calculated on the basis of the Goldberger model, and are given for 100 incident protons. The secondary evaporation cross sections were then calculated from the statistical theory. There is a considerable discrepancy between the calculated and experimental cross sections, and an explanation is given of this. (L.M.T.)

676

MASS ASSIGNMENT AND GAMMA-RADIATIONS OF THE SEVEN-HOUR MOLYBDENUM ISOMER. G. E. Boyd and R. A. Charnie. *Phys. Rev.* 88, 681-2(1952) Nov. 1.

The mass assignment of the 7-hr isomer of Mo as Mo^{93} has been confirmed by observing the γ and β decays of Nb irradiated with 20-Mev protons. γ -Ray spectral measurements of a Mo fraction separated from the irradiated Nb and exhaustively purified showed energy peaks of 290,690, and 1464 kev for the 7-hr half life. Measurements from the original Nb yielded the same peaks plus a 905-kev γ from the Nb^{92} formed by a (p,pn) reaction. The β decay was resolvable to only two periods—the 6.95-hr Mo and the 10.2-day Nb^{92} . The yield curves of the 6.95 hr Mo and Nb^{92} showed threshold energies of about 4.5 and 13.3 Mev respectively, the Mo had a maximum at 11.5 Mev, while the Nb^{92} had not reached a maximum at 19.5 kev. The excitation curves for the (p,pn) and $(p,2n)$ reactions on Nb^{93} should resemble each other except for about 0.6 Mev difference in threshold. Therefore it was concluded that the 6.95-hr isomer is formed by a (p,n) reaction with Nb^{93} and must be assigned to mass number 93. (L.M.T.)

PARTICLE ACCELERATORS

677

Case Inst. of Tech.

PROGRESS REPORT [ON THE] NUCLEAR PHYSICS PROGRAM [FOR] SEPTEMBER 15, 1951 TO SEPTEMBER 15, 1952. [nd] 35p. (AECU-2312)

Modifications in the Case betatron during the period have included installation of a refrigeration unit for the diffusion pump, a new electron injector, and a new donut. Orbit dynamics, electron beam removal, operation for cloud chamber use, and conversion to a synchrotron are discussed in connection with the betatron. Results of numerous experimental and theoretical studies, most of which have been published elsewhere, are summarized. (G.Y.)

678

Radiation Lab., Univ. of Calif., Berkeley
OPERATION OF THE BERKELEY BEVATRON POWER SUPPLY REGULATORS, by Robert A. Bruns. Aug. 1952. 18p. (UCRL-1932)

Block diagram studies are made of the Berkeley bevatron regulators in an effort to determine important constants of the over-all system and their relative effects. Since system response is dependent on load reaction during pulses, an artificial block representing this effect must be placed in the feedback control system diagram. Some experimental results are given showing single operation of each machine and multiple operation of both. These data are interpreted, and suggestions are made for further improvement and study. (auth)

RADIATION ABSORPTION AND SCATTERING

679

Knolls Atomic Power Lab.

THE LOCATION OF OXYGEN ATOMS IN VANADIUM-OXYGEN ALLOYS BY MEANS OF NEUTRON DIFFRACTION, by C. W. Tucker, Jr., A. U. Seybolt, and H. T. Sumsion, Knolls Atomic Power Lab. and E. O. Wollan and W. C. Koehler, Oak Ridge National Lab. [nd] 14p. (AECU-2287)

A comparison of x-ray and neutron diffraction is made for the purpose of locating oxygen atoms in vanadium-oxygen alloys. For higher oxygen alloys, such as VO, it is found that either method is satisfactory. In the region of low oxygen content neutron diffraction possesses a large advantage due to the large scattering factor for oxygen and the low value for vanadium with neutrons. In an alloy containing 21.0 at. % oxygen, the oxygen atoms are found in the octa-

hedral positions of a body-centered tetragonal lattice as inferred by earlier workers using x-ray diffraction. (auth)

680

Brookhaven National Lab.

THE TOTAL n-p SCATTERING CROSS SECTION AT 4.75 MEV, by E. M. Hafner, W. F. Hornyak, C. E. Falk, G. Snow, and T. Coor. Aug. 27, 1952. 61p. (BNL-1261)

Attenuation measurements in good geometry on polyethylene and graphite scatterers with transmissions from 0.30 to 0.65 have been made. A thin-walled gas target was used, producing forward D-D neutrons at a mean energy of 4.749 ± 0.009 Mev. Care was taken to minimize uncertainties arising from neutrons of other energies, from unshadowed background, and from impurities in the samples. The geometry was such that multiple scattering-in contributed no more than 0.12% to the total uncertainty. Checks against rate-dependent sensitivity of the detector revealed no effects greater than 0.15%. The total n-p scattering cross section deduced from the measurements is 1.690 ± 0.006 barns, where the probable error has been increased from the statistical error of 0.0024 barn to include the energy uncertainty and estimates of unknown systematic effects. Values of $r_{os}^{(n-p)}$, the singlet effective range of the n-p interaction, obtained from this result for several potential shapes, are compared with corresponding values of $r_{os}^{(p-p)}$. The validity of the hypothesis of charge independence is found to depend on the potential shape assumed. (auth)

681

Radiation Lab., Univ. of Calif., Berkeley

A TEST OF THE CHARGE SYMMETRY HYPOTHESIS: POSITIVE TO NEGATIVE PION PRODUCTION RATIO OBTAINED IN BOMBARDING CARBON WITH ALPHA PARTICLES AND PROTONS, by H. W. Wilson and Walter H. Barkas. Oct. 1952. 10p. (UCRL-1991)

A measure of the plus/minus ratio for the production of pions by alpha particles incident on carbon nuclei has been carried out to test the charge-symmetry hypothesis. Employing an experimental procedure which eliminates residual errors in geometry, etc., the ratio was found to be 0.72 ± 0.17 . The alpha-particle energy was 375 Mev and the meson energy was 15 Mev observed at 90° to the beam. Coulomb effects are expected to bring about a depression of the production ratio from unity of about this magnitude. The experimental result, therefore, provides support for the charge-symmetry hypothesis. As supplementary information the same apparatus was used to measure the pion plus/minus ratio for 330-Mev protons incident on carbon. The ratio found was 5.4 ± 0.8 . (auth)

682

EVALUATION OF INTEGRALS IN THE THEORY OF ATOMIC SCATTERING OF ELECTRONS. E. Corinaldesi and L. Trainor. *Nuovo cimento* (9) 9, 940-5(1952) Oct. (In English)

It is shown how methods recently developed in field theory can be applied to exact evaluation of some integrals appearing in the calculation of the differential cross section for the scattering of electrons by atoms. (auth)

683

TOTAL IONIZATION OF POLONIUM α PARTICLES IN ARGON AND NITROGEN. G. Bertolini, M. Bettoni, and A. Bisi. *Nuovo cimento* (9) 9, 1004-7(1952) Oct. (In Italian)

The total ionization produced by α particles from Po^{210} has been measured in pure A and N. A and N were purified by a Ca-Mg-filled convection-current purifier. Electron collection was employed, using a fast amplifier feeding an ordinary discriminator. The average energies w spent in producing an ion pair in A and N are as follows: $w_A = 28.9 \pm 0.6$ ev, $w_N = 37.9 \pm 0.8$ ev. The results are in good agreement

with the measurements of Stetter's laboratory (*Z. Physik* 120, 639(1943)). (auth)

684

DETERMINATION OF MULTIPOLE ORDERS FROM INTERNAL PAIR FORMATION. Hilding Slätis and Kai Siegbahn. *Arkiv Fysik* 4, 485-94(1952) (In English)

A survey is given of the different ways in which the multipole orders of transitions may be determined. Earlier measurements of positrons originating in pair creation are described. By the use of a β spectrometer with high transmission (the intermediate image β spectrometer) the internal pair formation for the γ rays emitted in the decay of ThC' (Tl^{208}), Na^{24} , Mn^{56} and Co^{60} were investigated. The coefficients were compared with the theoretical ones of Jaeger and Hulme, and the multipole orders are given. Some general conclusions about the method are drawn. (auth)

685

ON THE SCATTERING OF SLOW NEUTRONS BY POLYCRYSTALS. Per Olof Fröman. *Arkiv Fysik* 5, 53-60(1952). (In English)

An earlier investigation by Weinstock (*Phys. Rev.* 65, 1(1944)) is simplified and generalized. The treatment is limited to crystals so small that the kinematical diffraction theory can be used. For simplicity, such complications as magnetic interaction, spin-dependent interaction, and isotopic disorder are disregarded. The treatment is based on formulas for the differential scattering cross section of a single crystal which were derived in a previous paper by the present author (*Arkiv Fysik* 3, No. 10). (L.T.W.)

686

PHOTON ABSORPTION CROSS SECTIONS IN BISMUTH AND TANTALUM. J. Halpern, R. Nathans, and A. K. Mann. *Phys. Rev.* 88, 679-80(1952) Nov. 1.

The excitation functions were measured for neutron yield from Bi and Ta and the (γ, n) and $(\gamma, 2n)$ components separated, using a method of delayed neutron detection (Sher, *Phys. Rev.* 84, 387(1951)). Bremsstrahlung of maximum energy from the Univ. of Penna. betatron were impinged on 434 mg/cm² Bi and 468 mg/cm² Ta targets. Curves are given of the neutron yield from both targets, the excitation function for neutron yield in Ta, and total cross section of both Ta and Bi. The total integrated cross sections are 2.8 Mev-barns for Ta, and 3.0 Mev-barns for Bi. (L.M.T.)

RADIATION EFFECTS

687

Ames Lab.

RADIOCHEMICAL STUDIES ON THE PHOTOFISSION OF THORIUM, by Dale M. Hiller and Don S. Martin, Jr. June 1952. 56p. (ISC-227)

Radiochemical methods were used to determine photofission yields in Th. The estimated shape of the photofission-yield curve had the double-humped appearance common to most fission-yield curves. The ratio of most probable yield to symmetric yield was 10, the width of the peaks at half-height was 12 mass units, and the maximum yields were 6.9% at masses 91 and 138. An average of three neutrons was emitted per fissioned nucleus. Radiochemical methods for separating Cd and Ce from the acidic Th solution are described, and the separation of I and Br from HCl-Th solution and from each other by means of controlled oxidation with Ce(IV) prior to CCl_4 extraction proved successful. The following statements are made concerning the photofission process: the peaks of the photofission-yield curve increase in width with mass number of the excited nucleus, but are always narrower than the peaks of yield curves resulting from neutron fission; the ratio of the most probable mode of fission to symmetric fission increases with

mass number of the excited nucleus; the light side of the photofission-yield curve essentially coincides with that of the corresponding neutron-fission curve, whereas the heavy side seems to be shifted more than one mass number in the light direction; and the neutron yield of the photofission process is little if any larger than that of spontaneous fission. 102 references. (L.T.W.)

688

Princeton Univ.

TEMPORARY AND PERMANENT EFFECTS PRODUCED BY RADIATION ON SOLIDS: THE EFFECT OF NEUTRON BOMBARDMENT ON A ZINC SULFIDE PHOSPHOR, by Alan W. Smith and John Turkevich. Aug. 1, 1952. 72p. (NYO-3280)

The study of the effects of neutron bombardment on the luminescence properties of a copper-activated zinc sulfide phosphor leads to the conclusion that the chief result of the bombardment is the production of deep electron traps, killer traps, which capture electrons excited into the conduction band and which lose these electrons nonradiatively to holes in the filled band which have migrated from empty emission centers. X-ray excitation produces "spots" of high intensity excitation of electrons from the filled band to the empty band. The changes in the dielectric properties support the view of killer-trap production and the hypothesis that trapped electrons are responsible for the dielectric changes. The effects of bombardment can be annealed out completely at high temperatures. Grinding this phosphor does not produce killer traps but does produce deep luminescence-active traps. (auth)

RADIOACTIVITY

689

Mound Lab.

RADIUM DETERMINATION BY ALPHA COUNTING (Final Report), by H. W. Kirby. Mar. 15, 1952. Decl. Sept. 2, 1952. 14p. (AECD-3463; MLM-675)

A method is described for the determination of radium by alpha counting. A dilute hydrochloric acid solution of the radium sample is passed through a short column of copper powder to remove polonium. The effluent is mounted on glass slides and alpha-counted four to five hours after mounting. Twenty-four hours after mounting, the slides are counted again, and the percentage increase in counts is used to determine a correction factor for the growth of radon and its daughters. Precision and accuracy are within the limits of the counting instrument used. (auth)

690

Argonne National Lab.

RADIATION OF Pu^{243} , by D. W. Engelkemeir, P. R. Fields, and J. R. Huizenga. Oct. 1952. Decl. Dec. 3, 1952. 18p. (AECD-3474; ANL-OCS-289)

The radiations of Pu^{243} were studied with β and γ scintillation spectrometers alone and in coincidence. An incomplete disintegration scheme is deduced which leads to a total β -disintegration energy of 560 kev. A half life of 4.98 ± 0.02 hr was observed. (auth)

691

Brookhaven National Lab.

THE DECAY SCHEME OF Rh^{106} , by David E. Alburger. Aug. 13, 1952. 5p. (BNL-1288)

Four beta-ray groups and six gamma-ray lines have been found in the decay of Rh^{106} by means of lens and scintillation spectrometers. It is shown that the two strongest gamma-rays of energy 0.513 and 0.624 Mev are electric quadrupoles forming a 0-2-0 cascade. The measurements are consistent with beta decay to states in Pd^{106} at 0, 0.513, 1.137, 1.55, and 2.42 Mev which have even parities and spins of 0, 2, 0, 2, and 2, respectively. Rh^{106} is assigned spin 1 and even parity. (cf. NSA 6-5229) (auth)

692

Brookhaven National Lab.

NEUTRON DEFICIENT ISOTOPES OF Hg, by J. W. Mihelich, Brookhaven National Lab. and K. Gopalakrishnan and A. de-Shalit, Palmer Physical Lab., Princeton Univ. Oct. 14, 1952. 1p. (NYO-3663)

A study of Hg^{195} and Hg^{193} was undertaken in order to look for a possible "family" of similar decay schemes. The isotopes were prepared by bombarding an Au target with high energy protons at the Nevis Cyclotron Laboratory. The Hg was then separated carrier free and studied in a high-resolution double-focusing spectrometer at the Palmer Laboratory, Princeton, New Jersey, and in the permanent-magnet spectrograph at Brookhaven National Laboratory. The decays of both Hg^{195} and Hg^{193} were found to be similar to those of Hg^{199} and Hg^{197} —M4 isomeric transition followed by another γ in cascade. As in Hg^{197} , the isomeric states in $\text{Hg}^{195,193}$ have also a branching to isomeric states in $\text{Au}^{195,193}$ which decay by the emission of E3 and M1 in cascade to the ground states of the respective nuclei. Further work is in progress. (Entire report)

693

THE PROBLEM OF THE STABILITY OF TECHNETIUM. E. Segrè. *Nuovo cimento* (9) 9, 1008-11(1952) Oct. (In English)

A discussion, based on nuclear, geochemical, and astronomical data, on the possible existence of isotopes of technetium with a period longer than 10^9 yr is presented. The only possible isotopes are Tc^{97} and Tc^{98} , which, although radioactive, might have very long periods. (auth)

694

Cr^{55} , A NEW CHROMIUM ISOTOPE WITH 3.52-MIN HALF LIFE. A. Flammersfeld and W. Herr. *Z. Naturforsch.* a7, 649-51(1952) Oct. (In German)

Cr^{55} was prepared by the $\text{Cr}(n,\gamma)$ and $\text{Mn}^{55}(n,p)$ reactions. The half life is 3.52 ± 0.03 min, and β particles with maximum energy 2.85 Mev are emitted. No γ rays are present. (tr-auth)

695

ON THE DECAY OF $\text{Kr}^{88} \rightarrow \text{Rb}^{88} \rightarrow \text{Sr}^{88}$. Sigvard Thulin. *Arkiv Fysik* 4, 363-81(1952). (In English)

The decay scheme of the 2.77-hr Kr^{88} is difficult to study because of the active daughter product Rb^{88} (17.8 min.). The author has measured the β spectra of electromagnetically separated $\text{Kr}^{88} + \text{Rb}^{88}$ and of electrostatically deposited Rb^{88} . The Kr^{88} spectrum is obtained as the difference between these two normalized spectra. The investigation includes the following main parts: Methods of extracting fission gases from n-irradiated uranium samples are described, as well as the technique of preparing weightless β samples of Rb^{88} on thin backing foils. The electromagnetic separation of genetic activities is discussed in connection with the pair $\text{Kr}^{88} + \text{Rb}^{88}$. The β spectrum of Rb^{88} has been measured. A Fermi analysis gives three components of energies 5.30, 3.6 and 2.5 Mev. The later value removes an earlier uncertainty in the decay scheme of Rb^{88} . The β -spectrum of $\text{Kr}^{88} + \text{Rb}^{88}$ has been measured. An analysis of the Kr^{88} difference spectrum gives β components of energies 2.7, 0.9 and 0.52 Mev. Conversion lines of a 28.0-kev γ ray were found and $e^-\beta$ -coincidence measurements in the β spectrometer show that this γ ray is in coincidence with a β component of energy ~ 0.5 Mev. In a discussion of the results, the possibility that the 2.8-Mev β component of Kr^{88} may be of first forbidden shape is pointed out. The question of the existence of a 0.9-Mev β component in Kr^{88} is discussed as well as the low experimental internal conversion coefficient of the 28-kev γ ray. (auth)

696

ENERGY DETERMINATION OF THE Se^{77m} γ -RAY. Jonas Orring. *Arkiv Fysik* 4, 469-70(1952). (In English)

Se^{77} was irradiated with fast neutrons from $\text{Li}(6\text{-Mev } d, n)$ for 50 sec and measured in a β spectrometer. A plot of the resulting internal conversion line is shown. The value found for the γ -ray energy was 165 kev. (L.T.W.)

697

CONCERNING STATISTICAL FLUCTUATIONS IN RADIO-ACTIVE PHENOMENA. Eric Rodgers and Sarah H. Rodgers. *Am. J. Phys.* 20, 471-3(1952) Nov.

A recent paper by Grundl, Kariotis, and Barkow (*Am. J. Phys.* 20, 35(1952)) on statistical fluctuations in radioactive phenomena is discussed. It is shown how their theory may be improved. Also, some results of experiments on the same subject by the present authors are presented. (auth)

698

Q-VALUES FOR (αp) -REACTIONS ON FLUORINE AND SODIUM. Elis Hjalmar and Hilding Slätis. *Arkiv Fysik* 4, 323-9(1952). (In English)

Some Q-values for the reactions $\text{F}^{19}(\alpha p)\text{Ne}^{22}$ and $\text{Na}^{23}(\alpha p)\text{Mg}^{26}$ have been measured by means of photographic emulsions, and these values are compared with earlier results obtained by other authors. (auth)

699

INTERNAL CONVERSION OF THE Sr^{88} GAMMA-RAYS. F. R. Metzger and H. C. Amacher. *Phys. Rev.* 88, 147-8(1952) Oct. 1.

The internal conversion of the Sr^{88} γ rays were reinvestigated. Using a Y^{88} source and lens spectrometer of 2.5% resolution, the internal conversion peaks obtained were compared with the photoelectron peaks from a Au converter of known efficiency. The results compare well with those of Rose (report ORNL-1023 (unpublished)). The conversion coefficients characterize the 900-kev transitions as E1, and the 1.85-Mev transition as M1 and E2. (L.M.T.)

700

ENERGY LEVELS ASSOCIATED WITH THE RADIOACTIVE DECAY OF Gd^{153} AND Tb^{161} . J. M. Cork, J. M. LeBlanc, W. H. Nester, and F. B. Stumpf. *Phys. Rev.* 88, 685-6(1952) Nov. 1.

The irradiation of Gd in a pile yields 2 long-lived radioactive emitters. One is believed to be Gd^{153} with a half life of about 230 day and is formed by neutron capture from Gd^{152} . The other activity of about 7-day half life is from Tb^{161} and is formed by β - γ decay from short-lived Gd^{161} . Decay schemes are given for both of these isotopes. (L.M.T.)

701

SOME EXPERIMENTS ON Ge^{75} AND Ge^{75m} . Alan B. Smith, R. S. Caird, and Allan C. G. Mitchell. *Phys. Rev.* 88, 150 (1952) Oct. 1.

Ge^{75} was investigated by means of a magnetic lens spectrometer, a scintillation spectrometer, and coincidence-counting techniques. Two β groups were found having end-point energies, relative abundances, and $\log ft$ values of 1.137 Mev, 85%, and 5.2; and 0.614 Mev, 15%, and 4.5, respectively. Two internal conversion lines were seen, a well-resolved one at 0.408 Mev and an unresolved group at ~ 0.520 Mev. The γ rays measured from observations of photoelectrons from a U radiator showed a line at 0.265 Mev and also a Compton distribution for a line around 0.600 Mev. Weak lines at 0.418 and 0.572 Mev were seen on the scintillation spectrometer. In the β - γ coincidence experiments, no coincidences were found between the high-energy groups, showing that the high-energy group leads to the ground state. (L.M.T.)

702

K^{40} RADIOACTIVE DECAY: ITS BRANCHING RATIO AND ITS USE IN GEOLOGICAL AGE DETERMINATIONS. A. K. Mousuf. *Phys. Rev.* 88, 150-1(1952) Oct. 1.

The ratio of K capture to β emission for the naturally occurring radioactive isotope K^{40} has been determined. For this purpose argon was extracted from four different samples of microcline and purified. The volume of the extracted argon was measured by means of a McLeod gauge built into the apparatus, and the amount of radiogenic A^{40} was ascertained by mass spectrometric analysis of the isotopic abundances in the extracted argon. The K contents of the samples of microcline were determined by chemical analysis, and the amount of K^{40} was estimated using the recent value of Nier, $0.0119 + 0.0001\%$ (*Phys. Rev.* 77, 789(1950)), as the isotopic abundance of K^{40} in K. The branching ratios determined ranged from 0.053 to 0.066 for the four samples, in good agreement with other workers. (auth)

703

GEIGER-NUTTAL RELATION AND α -RAY SPECTRA. M. L. Chaudhury. *Phys. Rev.* 88, 137(1952) Oct. 1.

In the typical curves given for various α spectra each element is considered individually with regard to the relation $\log \lambda$ vs. decay energy E. Partial α -decay constants λ_k are plotted against the corresponding decay energies, and points for the same Z and same mass number A are joined. Both positive and negative trends exist in the variation of λ_k with E, instead of the usual positive gradient of the Geiger-Nuttall relation. The simplest spectra are the doublets which give either the positive trend only (e.g., the Th spectra) or the negative trend only (e.g., U^{235}). For the triplet spectra, a positive trend is followed by a negative one (e.g., Bi^{214}) or vice versa, while in the case of the Th^{228} triplet, only a negative trend exists. The significance of these results to α -decay theory is discussed. (L.M.T.)

704

ISOMERIC LEVELS IN Pb^{201} AND Pb^{202} . N. J. Hopkins. *Phys. Rev.* 88, 680-1(1952) Nov. 1.

Gamma activities following proton bombardment of Tl targets were studied by means of a NaI scintillation spectrometer, and from the decay periods of 50 and 5.6 sec assignments were made to isomeric levels of Pb^{201} and Pb^{202} , respectively. The γ energies measured were 0.67, 0.42, and 0.25 Mev for the 50-sec decay and 0.89 Mev for the 5.6-sec decay. The assignments were further verified by comparison of the thresholds for production with the threshold for production of 8-hr Pb^{201} . Comparison of the energy of the 5.6-sec γ ray with the energy of the γ ray found in Po extracted from a Bi target indicated that the α decay of Po^{208} goes to the excited level of Pb^{202} . (L.M.T.)

SHIELDING

705

Argonne National Lab.

CORROSION OF MATERIALS FOR TRANSPARENT RADIATION SHIELDS, by J. E. Draley and P. G. Drugas. Oct. 28, 1949. 39p. (ANL-4837)

A number of materials have been tested for corrosion resistance to concentrated ZnBr_2 solution, and several for corrosion resistance to acetylene tetrabromide at 35°C . On the basis of such tests, it is recommended that transparent radiation shields be fabricated of preoxidized stainless steel, using tygon as gasket for attaching glass windows. With this type of construction, ZnBr_2 solution, of low Fe content, probably can be used successfully as a high-density transparent wall material. Type 347 stainless steel seems to be slightly more corrosion resistant for this application

than type 316 and has better welding properties. The black oxide coat which was used in testing probably can be omitted, if it is thought desirable to do so. (auth)

SPECTROSCOPY

706

Argonne National Lab.

ISOTOPE SHIFT IN THE PLUTONIUM SPECTRUM, by John G. Conway, Radiation Lab., Univ. of Calif., Berkeley and Mark S. Fred, Argonne National Lab. Sept. 26, 1952. Decl. Dec. 2, 1952. 5p. (AECD-3466; ANL-4889)

Isotope shifts were measured in the Pu spectrum using a mixture of Pu^{238} and Pu^{242} and a mixture of Pu^{240} and Pu^{239} . Pure Pu^{239} was used as a reference. Four lines were observed in the second and third orders for both samples, but high precision could not be obtained for all of them because of low intensity. The 4021 Å line gave the best pattern. The accuracy is estimated to be ± 0.005 Å. (L.T.W.)

THEORETICAL PHYSICS

707

TENSORS THE ELEMENTS OF WHICH ARE DIRAC MATRICES. Friedrich L. Bauer. *Compt. rend.* 235, 793-4(1952) Oct. 13. (In French)

The following theorem is proved: The characteristic of the spinor representation $2\nu + 1\text{O}(m_1 + \frac{1}{2}, m_2 + \frac{1}{2}, \dots, m_\nu + \frac{1}{2})$ (m_1 integral) of the orthogonal group of dimension $2\nu + 1$, that is, the characteristic of the principal representation which results from the fusion $2\nu + 1\text{O}(m_1, m_2, \dots, m_\nu) \times 2\nu + 1\text{O}(\frac{1}{2}, \frac{1}{2}, \dots, \frac{1}{2})$ of a tensor representation with the representation by the generalized matrices of Dirac (Clifford algebra), is the product of the characteristics of the representation $2\nu + 1\text{O}(\frac{1}{2}, \frac{1}{2}, \dots, \frac{1}{2})$ and the representation $2\nu\text{Sp}(m_1, m_2, \dots, m_\nu)$ of the group symplectic in 2ν dimensions. Thus, in the wave equations for spin- $\frac{1}{2}$ particles the wave functions always form a tensor symplectic with the coefficients of Dirac's algebra. (G.Y.)

708

THE COMMUTATION LAWS IN THE THEORY OF QUANTIZED FIELDS. M. Cini. *Nuovo cimento* (9) 9, 1025-8 (1952) Oct. (In English)

The relation of Peierls' method for obtaining the commutation laws between field quantities in the Heisenberg representation at any two different space-time points to Schwinger's formulation of quantized fields has been investigated. The reason for failure of Peierls' rule in the case of arbitrary functions of field variables is demonstrated. (G.Y.)

709

FOURTH-ORDER VACUUM POLARIZATION. M. Baranger, F. J. Dyson, and E. E. Salpeter. *Phys. Rev.* 88, 680(1952) Nov. 1.

The contribution from vacuum polarization to the fourth-order radiative correction to the motion of an electron in an external field was calculated. To lowest order in q^2 , the three given Feynman diagrams give a correction potential whose ratio to the zero-order potential is of the form $K(\alpha/\pi)^2(q^2/m^2)$, where α is the fine structure constant, q the potential, m the electron mass, and K a dimensionless constant to be determined. The value K determined by Feynman formalism is $41/162$. The vacuum polarization terms have a non-zero expectation value for the 2S state of hydrogenic atoms, zero-expectation value for the 2P state, and contribute to the Lamb shift in an amount of about -0.239 Mc for H and D. (L.M.T.)

710

A VARIATIONAL METHOD FOR RADIATIONLESS TRANSITIONS. B. H. Bransden and A. Dalgarno. *Phys. Rev.* 88, 148(1952) Oct. 1.

This note considers, in particular, a variational method for the auto-ionization of an excited atomic system. (L.M.T.)

TRACER APPLICATIONS

711

Yale Univ.

SELF-DIFFUSION AND STRUCTURE OF LIQUID WATER. III. MEASUREMENT OF SELF-DIFFUSION OF LIQUID WATER WITH H^2 , H^3 , AND O^{18} AS TRACERS, by Jui Hsui Wang. Oct. 23, 1952. 21p. (NYO-3871)

Measurements of the diffusion of small amounts of deuterium hydroxide and tritium hydroxide in ordinary water were made at several temperatures. Previous data on the diffusion of H_2^{18}O in ordinary water have been revised. The results confirm previous conclusions regarding the structure of water and the mechanism of self-diffusion, dipole orientation, and viscous flow in water. The effect of the differences in the moments of inertia of various water molecules is discussed. (auth)